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SLOAN (W. J. S.). **Cotton Jassids or Leafhoppers.**—*Qd agric. J.* **50** pt. 4 pp. 450–455, 15 refs. Brisbane, 1938.

The infestation of cotton by Jassids of the genus *Empoasca*, including *E. terrae-reginae*, Paoli, and probably other species, has been recorded of recent years in hitherto uninfested regions of Queensland. Injury to the plants generally becomes noticeable after heavy rains in February-March, when the crop is approaching maturity. If cotton is planted during September-October, good yields are generally obtained from the lower and middle crops of bolls that mature before the peak of the attack, but the yield of late-planted cotton may be seriously reduced, especially after dry weather or infestation by the corn-ear worm [*Heliothis armigera*, Hb.]. Young plants may be attacked during dry periods by Jassids migrating from weeds, with the result that the stunting caused by low soil moisture is accentuated, the leaves wilt and the main terminal shoot becomes distorted; if the crop survives the combined effect of drought and Jassid attack, it will recover after heavy rain. Infestation of maturing plants by adults and nymphs causes a brownish or red discoloration of the leaves, and curling. The leaves may be shed, particularly during showery weather, when moulds appear on injured foliage. Plant development is retarded and almost ceases with the general reddening; squares, flowers and young bolls are shed, and immature bolls develop poorly or dry up. The injury seems to be due chiefly to the injection of toxins by the Jassids, that from the nymphs being the more harmful, but also to the removal of sap.

In Queensland, Jassid attacks are associated with heavy rains during periods of cloudy weather, which induce sappy growth in the American varieties of cotton generally grown. Attacks occur on various types of soil, including forest alluvial soils which have hitherto been free. The use of Rhodes grass in rotation with cotton improves the soil, and a better fruiting type of plant, with less foliage, and less susceptible to Jassid injury, is produced than from soils cropped for several years with cotton, although most of the top crop may still be lost. In the absence of frosts, small numbers of adults and nymphs may remain on the cotton till mid-winter, and it is probable that they may continue to breed slowly on stand-over cotton throughout the winter. Resistant strains of cotton imported experimentally from South Africa grew well and were not seriously damaged by the Jassids, but the crop was inferior in quality to that produced by the variety generally grown. Resistant plants are typically hairy on the lower surface of the leaves, petioles, stems and involucral bracts. The relation between resistance and hairiness is not yet definitely established, but the length of the hairs appears to be more important than their density.

The bionomics of the species involved are probably similar to those of *Empoasca viridigrisea*, Paoli, which is the species that has been recorded from tomato in Queensland [*cf. R.A.E.*, A **22** 62].

Some control was given by dusts containing 2 and 3 per cent. nicotine and by two proprietary dusts containing 3·2 per cent. tubatoxins as derris and 0·13 per cent. pyrethrins as pyrethrum, and 1 per cent. nicotine and 5 per cent. creosote, respectively, applied at the rate of 15–20 lb. per acre, but the frequent applications that would be necessary make their use economically impracticable.

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No control was given by flowers of sulphur. The measures recommended are early planting, the use of Rhodes grass in rotation, and the cultivation or planting with Rhodes grass of stand-over cotton and weedy land on which the Jassids may overwinter.

CURRIE (G. A.) & FYFE (R. V.). **The Fate of certain European Insects introduced into Australia for the Control of Weeds.**—*J. Coun. sci. indust. Res. Aust.* **11** no. 4 pp. 289–301, 1 pl., 10 refs. Melbourne, 1938.

The following is based on the authors' summary: Since 1929, phytophagous insects have been introduced into Australia from England and France for the control of the introduced weeds, St. John's wort (*Hypericum perforatum*) and ragwort (*Senecio jacobaea*) [*R.A.E.*, A **20** 612, etc.]. The insects that have so far been introduced have disappeared after a shorter or longer period, although liberations have been made over a number of years in many different places within the weed-infested areas. An account is given of observations made in the field on the behaviour and fate of the insects liberated. *Chrysomela* (*Chrysolina*) *varians*, Schaller, *C.* (*C.*) *hyperici*, Forst., and *C.* (*C.*) *brunsvicensis*, Grav., released on St. John's wort, failed to become established [*cf.* **25** 321], being exposed in some places to an unfavourable environment and in others to the attacks of ants, spiders, birds and bugs. Several thousand larvae of the Geometrids, *Anaitis plagiata*, L., and *A. efformata*, Gn., liberated on St. John's wort [*cf.* **23** 397; **26** 450] were destroyed in a few weeks by ants. Large numbers of the Arctiid, *Tyria jacobaeae*, L., [**26** 450] were liberated on ragwort, but the larvae and adults were destroyed by the scorpion fly, *Harpobittacus australis*, Klug, within a few weeks.

The ease with which some phytophagous insects have become established in new countries, as compared with the difficulty experienced with others, is discussed, and it is suggested that the liberation of small colonies suffices to show whether an imported insect is able to adapt itself to a new environment. The release of large numbers does not assist establishment.

DAY (M. F.). **Preliminary Observations on the Gaseous Environment of *Eutermes exitiosus* Hill (Isoptera).**—*J. Coun. sci. industr. Res. Aust.* **11** no. 4 pp. 317–327, 1 fig., 5 graphs, 12 refs. Melbourne, 1938.

The following is the author's summary: A concentration of carbon dioxide approximately 50 times that of the normal atmosphere, while injurious to many animals, is the normal environment of certain termites. The conditions of gas tension have been studied in the mounds of *Eutermes exitiosus*, Hill, in the standard laboratory colonies of this species, and in the warm room where the colonies are kept. The results with mounds indicate that there is very little actual ventilation through the termitarium. There is evidence that carbon dioxide and oxygen diffuse through the mound material at different rates, but the factors influencing this are not understood. The effects of these conditions in the mounds are discussed.

La pyrale des pommes *Laspeyresia* (*Carpocapsa*) *pomonella* **L.**—*Memento Déf. Vég. Dir. Aff. écon.* [*Maroc*] no. 51, 18 pp., 4 pl. Rabat, 1938.

The information in this paper is largely an amplification of that contained in one previously noticed [*R.A.E.*, A **22** 354], based partly on subsequent observations. It is now stated that *Cydia* (*Laspeyresia*) *pomonella*, L., has two generations a year on apple in Morocco, and that although the minimum duration of the diapause in larvae of the overwintering generation is only a month, it may last for 2 years. The calendar for control measures [*loc. cit.*] is slightly modified.

Les lixus parasites de la betterave *Lixus junci* **Boh.**—*Memento Déf. Vég. Dir. Aff. écon.* [*Maroc*] no. 53, 8 pp., 1 pl. Rabat, 1938.

An account is given of the bionomics of *Lixus junci*, Boh., on beet in Morocco [*cf. R.A.E.*, A **26** 416], where it causes crop losses of up to 40 per cent. Leaves attacked by the weevil quickly wither and fall, and their collection in spring and immediate destruction or use as fodder is recommended, to destroy the larvae and pupae. Successive plantings of beet should be made as far as possible from preceding ones. A row of beets planted as a trap on the site previously under beet attracts large numbers of overwintered adults, which may then be destroyed. The adults can be controlled by a single application in spring of a spray consisting of 5 lb. lead arsenate powder containing 30 per cent. As_2O_5 (or 10 lb. paste containing 15–16 per cent.), or of 7½–10 lb. calcium arsenate paste containing 15–16 per cent. As_2O_5 and 20 lb. lime, both in 100 gals. water. Aluminium arsenate at an equivalent concentration would probably also be effective. A list of parasites of *L. junci* is the same as that previously noticed [*loc. cit.*] except that the species of *Zeuxia* here given is *Z. cinerea*, Mg.

La casside de la betterave *Cassida vittata* **Vill.** = *oblonga* **Illig.**—*Memento Déf. Vég. Dir. Aff. écon.* [*Maroc*] no. 54, 6 pp., 4 pls. Rabat, 1938.

Cassida vittata, Vill., all stages of which are briefly described, often causes considerable injury to beet in Morocco. It has four overlapping generations a year ; the egg, larval and pupal stages last 10, 18–26 and 8–15 days, respectively, and females survive for 4–5 months. Overwintered females begin to oviposit early in February, and adults of the first, second and third generations appear from late March to late May, from late June to mid-August and from early September to early November, respectively. The adults of the fourth generation, which appear from late November, and late individuals of the third, hibernate. Females deposit an average of at least 300 eggs on the leaves. Both adults and larvae feed on the leaves, and plants may be defoliated in dry years. The treatment recommended is 3–4 applications, beginning when the adults appear in spring and effected while the leaves are still erect, of a suspension of 5 lb. lead arsenate powder (30 per cent. As_2O_5) or 10 lb. paste (15–16 per cent. As_2O_5) in 100 gals. water. Older plants should be dusted with equal parts by weight of calcium arsenate (40–50 per cent. As_2O_5) and lime, to which some workers suggest the addition of 1 or 2 per cent. sodium fluosilicate.

The larvae are occasionally parasitised by *Brachymeria vitripennis*, Först., which pupates in the pupal skin of the host and completes its life-cycle in about 20 days.

WRIGHT (E.). **Further Investigations of Brown-staining Fungi Associated with Engraver Beetles** (*Scolytus*) **in White Fir.**—*J. agric. Res.* **57** no. 10 pp. 759–773, 6 figs., 13 refs. Washington, D.C., 1938.

Stains similar to those caused by the fungus *Trichosporium symbioticum* in the egg-galleries of *Scolytus ventralis*, Lec. [*R.A.E.*, A **25** 520], but lighter in colour, were found in the egg-galleries of *S. praeceps*, Lec., and *S. subscaber*, Lec., in white fir (*Abies concolor*) in California, and the causes of the variation in colour were investigated. The galleries of *S. ventralis*, *S. praeceps* and *S. subscaber* are formed in the cambial region of the base, the top and the branches of the tree, respectively. The larvae characteristically feed in the stained areas surrounding the egg-galleries.

Isolation of the fungi from the stained bark and adjacent sapwood of white fir and from newly-emerged adult Scolytids indicated that two species were involved, *T. symbioticum* being specific to *S. ventralis*, and another, identified as *Spicaria anomala*, to *S. praeceps* and *S. subscaber*. Experiments with *S. praeceps* indicated that the adults carry the fungus and inoculate the cambium when excavating their egg-galleries. Both fungi kill the cambium as they advance, thereby probably assisting the Scolytids in overcoming infested trees by providing a barrier against the inflow of resin, which might drown the broods and which is known to be repellent and toxic to the adults, and may be also to the larvae. *T. symbioticum* reduced the moisture content of the stained wood to about three-fifths of that of unstained wood, and *Spicaria anomala* reduced it still more. The larvae of *Scolytus praeceps* appear to require less moisture than those of *S. ventralis*.

BENTON (C.) & FLINT (W. P.). **The comparative Attractiveness of the various Small Grains to the Chinch Bug.**—*Circ. U.S. Dep. Agric.* no. 508, 7 pp. Washington, D.C., 1938.

Extensive field tests were carried out in Illinois during 1934–37 to investigate the relative attractiveness of small grains to overwintered adults of *Blissus leucopterus*, Say, and the effectiveness of discontinuing their cultivation or limiting them to trap-crops as a measure for control. Periodical field counts were made of adults and nymphs in selected areas of rye and spring and winter wheat, barley and oats. The preferences of bugs migrating from winter quarters varied with the weather during the spring and with the growth of the small grains. No small grain was so unattractive that its exclusive cultivation would obviate spring infestation and subsequent migration to maize, and none was sufficiently more attractive than the others to be used as a dependable trap or concentration crop. The presence of trap-crops did not prevent the infestation of oats, which, in the absence of other small grains, was heavy, and it was observed that the overwintered adults did not always remain on the grain to which they were first attracted. The use of special trap-crop plantings is considered to be economically impractical.

Flint (W. P.) & Bigger (J. H.). **Biological Control of Insects through Plant Resistance.**—*Canad. Ent.* **70** no. 12 pp. 244–246. Orillia, Ont., 1938.

This is a general discussion of the work that has been carried out in the United States on the production of plant strains that are resistant to the attacks of various insects.

Roark (R. C.). **Synthetic Organic Compounds used as Insecticides.**—*Canad. Ent.* **70** no. 12 pp. 248–253, 22 refs. Orillia, Ont., 1938.

The author reviews work (chiefly that carried out in the United States) on the value of synthetic organic compounds as insecticides. He emphasises the specificity in toxicity to various species of insects exhibited by such compounds, as a result of which many must be developed to take the place of a few arsenicals that are effective against a wide range of species.

Brannon (L. W.). **The Sweetpotato Leaf Beetle.**—*Circ. U.S. Dep. Agric.* no. 495, 9 pp., 4 figs., 2 refs. Washington, D.C., 1938.

Field studies made in North Carolina in the period 1931–36 on the bionomics and control of *Typophorus viridicyaneus*, Crotch, which occasionally causes damage to sweet potato in the southern United States, were supplemented by laboratory investigations in Virginia in 1931–33. This Eumolpid, all stages of which are briefly described, has been recorded from the southern and central states and from Mexico; it has been stated to feed on Convolvulaceae other than sweet potato, but was not observed to do so by the author. The adults feed on the leaves, and the larvae, which are more destructive, enter the vine below the surface of the soil, and bore into the tubers. Living larvae have been found in tubers 90 days after harvest; they may therefore be transported in them, but apparently do not readily become established by this means.

In the laboratory, the egg, larval and pupal stages (of 10 individuals) lasted 6–10, 263–319 and 16–21 days, respectively, and the larvae pupated on 10th–17th May. Pupation occurs in earthen cells several inches below the surface of the soil. The newly emerged adults remained in the cells for 4–5 days before making their way to the surface, and fed 2 days later. The preoviposition and oviposition periods averaged 14·1 and 29 days. Females deposited an average of 50 eggs (maximum 78) in clusters of 3–25. They occur normally just below the surface of the soil near the base of the plant, but in the laboratory about half were placed in folds of newly formed leaves. Adult life averaged 41·3 and 32·8 days in 1931 and 1932, respectively, the maximum recorded being 88 days.

In eastern North Carolina, adults are present from late May to mid-July, and eggs, which hatch in about 9 days, from late June to early August. Cage tests indicated that most larvae are full-grown and have left the tubers by harvest (August in this district). Young larvae remaining in the plants continue to develop until the frosts, but are apparently unable to survive the winter. The mature larvae hibernate from mid-October to mid-May at a depth of 6–8 ins. below the surface of the soil. Pupae occur from mid-May to early June. Of larvae hibernating in field cages and in jars in the laboratory, 28·3 and 33·65 per cent., respectively, survived the winter.

Since the preoviposition period lasts about 14 days, insecticides may be applied for some time after emergence begins. Field tests with various dusts were made during 1932, but were abandoned owing to the lightness of the infestation. In cage tests, undiluted calcium arsenate, and mixtures of barium fluosilicate (80 per cent.) and infusorial earth (1 : 2) or synthetic cryolite and talc (3 : 2) were highly toxic to the adults and more effective than derris or cubé dusts containing 0·5 per cent. rotenone or a spray (water suspension of ground derris root) containing 0·02 per cent. Several days after a field application of undiluted calcium arsenate dust, no living beetles were observed on the plants, but 40–50 dead ones were found near them.

WALLACE (J. M.) & MURPHY (A. M.). **Studies on the Epidemiology of Curly Top in Southern Idaho, with Special Reference to Sugar Beets and Weed Hosts of the Vector** *Eutettix tenellus*.—*Tech. Bull. U.S. Dep. Agric.* no. 624, 47 pp., 6 figs., 23 refs. Washington, D.C., 1938.

The following is based on the authors' summary of laboratory and field investigations in southern Idaho during 1929–1935 : Studies were made to discover the reaction of the most important wild food-plants of *Eutettix tenellus*, Baker, to the virus of curly top of sugar-beet and other crops and their rôle in supplying the vector with the virus. Of the spring food-plants of the Jassid, *Norta* (*Sisymbrium*) *altissima* and *Sophia parviflora* are of little importance as a source of virus, as the former is very difficult to infect and apparently inactivates it, while the latter, though rather more susceptible, usually attenuates it ; but *Sophia longipedicellata* is highly susceptible and is important in supplying the virus in the desert breeding areas of the Jassid. The chief summer and autumn food-plant is *Salsola pestifer*, which is susceptible, but sometimes attenuates the virus. The percentage of infected leafhoppers on *S. pestifer* in desert areas in autumn was low, and the virus carried was generally attenuated. The percentages of infected leafhoppers of the spring brood varied from 67 to 4, either the attenuated or virulent virus being carried, but on migration to beet fields in which the disease was developing, more of them became infected, and at harvest time nearly all carried virulent virus.

Under experimental conditions, the virus can survive the winter in living leafhoppers without apparent change in virulence, and can be recovered in spring from *Sophia parviflora* and *S. longipedicellata* infected with it during the previous autumn. Leafhoppers overwintering in cultivated areas are in some years important in initiating outbreaks of curly top, which may increase the damage from the disease.

Important factors in the influence of desert populations of *E. tenellus* on sugar-beet in Idaho are the proportion of infective leafhoppers migrating to the beet fields, the size of the overwintered population, the size and rate of development of the spring brood, and the prevalence and distribution of the wild food-plants. The spring brood becomes more highly infected during a warm, early spring season, but the virus supply may still be restricted by the scarcity of susceptible plants, or by other factors acting alone or in combination. It is probable that the populations that reach the beet fields are always large enough to cause serious damage unless resistant varieties are

used or general conditions are unfavourable. Migration to the fields began on or after 4th June in six years of high yield, but took place on or before 24th May in five years of poor harvest. An interval of relatively few days between the development of the first foliage leaves and infestation is advantageous to the beets, as the rapid growth which then takes place, especially after thinning, increases the resistance of the plant. The stage of development of the beets at the time of infestation will continue to be an important factor even with the general use of resistant varieties. Early planting and a short sowing period result in more or less negligible injury; late plantings may be seriously damaged.

Wisecup (C. B.) & Reed (L. B.). **Laboratory Studies of Poisoned Baits for the Control of the Southern Armyworm.**—*Florida Ent.* **21** nos. 3–4 pp. 39–47, 62–63. Gainesville, Fla., 1938.

Laboratory tests of poisoned baits against larvae of *Xylomyges* (*Prodenia*) *eridania*, Cram., which sometimes cause serious damage in Florida to vegetable crops shortly before harvest, are described, and are used to illustrate and emphasise the value of the factorial design method of experimentation and the application of the analysis of variance to the data obtained. The sampling units were five larvae confined separately in small containers with 50 mg. bait. Cryolite gave satisfactory results at concentrations of 1, 2½ and 7 lb. per 100 lb. bait in the presence or absence of unpoisoned food (leaves of sweet potato); Paris green was effective at the same rates in the absence of normal food; thiodiphenylamine (phenothiazine) gave some control, and, in view of its safety, is considered promising when used at high concentrations; cubé was of no value. Varying the constituents of baits containing Paris green and thiodiphenylamine showed that maize meal and cottonseed meal were equally effective. The addition of molasses increased the effectiveness of the bait, but the addition of lemon had no effect.

Walton (E. V.), Seaton (L.) & Mathewson (A. A.). **The Texas Leaf-cutting Ant and its Control.**—*Circ. U.S. Dep. Agric.* no. 494, 18 pp., 5 figs., 13 refs. Washington, D.C., 1938.

Atta texana, Buckley, is economically the most important species of fungus-growing ant in Texas, where it attacks cereal, forage, orchard, and vegetable crops. The distribution of the species in the southern United States is summarised, and an account is given of its bionomics and nests. Most plants are attacked, but those with milky juice appear to be avoided; the attack results in the complete defoliation of the plant. The ants cut leaves and young stems into pieces of approximately ⅜–½ in. in diameter and use them as a medium for the cultivation of the fungus on which they feed.

In laboratory experiments, complete mortality of both ants and fungus in 18 hours was obtained with carbon bisulphide at the rate of 1·6 cc. per cu. ft. and with sulphur vaporised or burnt at rates of 0·6 and 1·5 gm., respectively. Sulphur dust killed the fungus but not the ants, and Bordeaux dust was less effective. Field tests with the same materials and also calcium cyanide dust are described and discussed; carbon bisulphide was found the most effective and economical, and the easiest to apply. In 148 nests, the average quantities used per nest

were $3\frac{1}{4}$ U.S. pints when it was poured into the main entrances of the nest and exploded, and about half as much when it was placed in pans set in holes dug beside them or when it was applied with water. All three methods were effective, but the first and third were rather more reliable than the second. The third consists in pouring a few gallons of water down a large entrance in each of the active centres of the nest, to clear away obstructions and prevent the soil from absorbing the carbon bisulphide so readily, and following this immediately with $\frac{1}{3}$ or $\frac{1}{2}$ U.S. pint carbon bisulphide, washed down with a final pailful of water. None of the treatments caused injury to the surrounding vegetation, and crops could probably be planted a few hours after an application, which should be made as early as possible in the year before the queens have dispersed from their winter quarters in the middle of the nest to found individual centres of activity. Of 99 nest colonies treated between 5th February and 16th April 1935, 88 were destroyed after one treatment, ten required two treatments, and one required three. Some of the nests were again examined in June 1936, and all of these were still inactive.

A list is given of about 50 myrmecophilous species of Arachnids and insects found in the nests of *A. texana*. The only one of definite economic importance was *Cotinis longitarsis*, Casey, larvae of which were often very abundant in the waste material in the lower levels of the nests. It is suggested that the damage frequently caused to ripening fruit by the adults of this Cetoniid might be reduced by controlling the ant.

KEIFER (H. H.). **Eriophyid Studies III.**—*Bull. Dep. Agric. Calif.* **28** no. 2 pp. 144–162 (preprint 22 pp.) 14 pls. Sacramento, Calif., 1938.

This third paper of a series [*cf. R.A.E.*, A **27** 33 etc.] contains descriptions of 15 new species of Eriophyids from California, 4 of which belong to 4 new genera. They include *Mackiella phoenicis*, gen. et sp. n., on date palm (*Phoenix dactylifera*) ; *Gammaphytoptus camphorae*, gen. et sp. n., on *Cinnamomum camphora* ; *Diptilomiopus prunorum*, sp. n., on various species of *Prunus* including peach and plum ; *Rhyncaphytoptus ficifoliae*, gen. et sp. n., on *Ficus* sp. ; *Epitrimerus myersi*, sp. n., on avocado ; and *Oxypleurites maxwelli*, sp. n., on olive (*Olea europaea*). A list of the families and species of plants attacked is given, and also a key to the subfamilies and genera of Eriophyids, the genera represented in California being shown in heavy type.

WARDLAW (C. W.). **Banana Diseases. XII. Diseases of the Banana in Haiti, with special Reference to a Condition described as " Plant Failure."**—*Trop. Agriculture* **15** no. 12 pp. 276–282. Trinidad, 1938.

This paper deals mainly with the condition known as plant failure, which is attributed chiefly to soil factors, but also includes descriptions of other diseases of banana in Haiti. One of them is virus heart rot disease, which was observed in new plantations and is characterised by yellow striping or mottling of the leaves, a tendency to stem splitting in adult plants and to premature leaf-fall, and a localised necrosis of the tissues of the pseudostem. Plants in which the heart rot

condition is acute are killed or are incapable of bearing commercial fruit. This disease appears to be the same as the infectious chlorosis or mosaic described in Australia for the first time in 1930 [*cf. R.A.E.*, A **23** 182], and has recently been observed in Guadeloupe. In Australia, where it was found to be transmitted by the Aphid, *Pentalonia nigronervosa*, Coq., it has caused considerable losses and is now treated with the same severity as bunchy top. As *P. nigronervosa* has been observed in Haiti, the disease may become of serious importance there, and should be dealt with carefully. All plantations should be surveyed for infected plants, which should be destroyed by treatment with gas-oil. The disease should be made notifiable and subject to official supervision and treatment.

Insects responsible for direct damage to the banana in Haiti include the Coccid, *Chrysomphalus personatus*, Comst., which infests the leaves, and *Frankliniella insularis*, Frankl., which normally lives in leguminous crops, but apparently migrates to bananas when the bunches emerge from the pseudo-stem, and causes pin-head spotting of the fruits. The leguminous cover crop in new plantations and leguminous weeds should be cut down and mulched before the shooting of the bunches.

Mendes (L. O. T.). **Segunda contribuição sobre a ocorrência da "Traça da Batatinha"** (*Gnorimoschema operculella* (**Zeller**) (**Lepidoptera-Gelechiidae**) **no Estado de S. Paulo.** [A second Contribution on the Occurrence of *Phthorimaea operculella* in the State of São Paulo.]—*Jorn. Agron.* **1** no. 5 pp. 415–452, 15 pls., 7 refs. Piracicaba, S. Paulo, 1938.

Investigations in 1937 and 1938 showed that *Phthorimaea* (*Gnorimoschema*) *operculella*, Zell., all stages of which are described, was present in 14 localities throughout the State of São Paulo, Brazil [*cf. R.A.E.*, A **26** 320], where in addition to potato and tobacco (*Nicotiana tabacum*) it also attacks 7 other species of *Nicotiana* and egg-plant (*Solanum melongena*). In laboratory experiments in which it was reared on tobacco at 25·3°C. [77·54°F.], the preoviposition period and egg stage together averaged 7·6 days, the larval, prepupal and pupal stages 12, 2 and 7·5 days, and adult longevity 16·7 days. In field-cage experiments, females resulting from larvae reared on tobacco oviposited indifferently on tobacco and potato. The larvae also completed their development when females were allowed to oviposit on a number of other solanaceous plants, *Datura stramonium* being the most favourable for them. Females did not oviposit or larvae feed on tomato, *Capsicum*, *Petunia*, or 5 species of *Solanum*. The maximum percentages of infestation of tobacco and potato-plants in fields were 36 and 12·86, respectively, but it is considered that special measures of control are unnecessary, as *P. operculella* is satisfactorily controlled by natural enemies. In February 1938, 37·2 per cent. of the larvae in one locality were parasitised by a Eulophid of an undescribed genus close to *Dimmockia*, 23·9 by *Copidosoma* sp. and 8·9 by *Apanteles* sp. Of these, *Copidosoma* is the most promising. It pupates within the host larva, the pupal stage lasting 9–15 days and averaging 11·6, and an average of 27 adults was bred from each of 17 hosts.

The author discusses the status of the genus *Phthorimaea* and concludes that it is not distinct from *Gnorimoschema*.

Bondar (G.). **Notas entomologicas da Bahia. III.**—*Rev. Ent.* **9** fasc. 3–4 pp. 441–449, 8 figs., 15 refs. Rio de Janeiro, 1938.

In this paper, which is one of a series on pests in Bahia [*cf. R.A.E.*, A **26** 501], the adults are described of *Tetranychus tanajoa*, sp. n., which injures the terminal buds of bitter and sweet cassava (*Manihot utilissima* and *M. dulcis* var. *aipi*) causing deformation and fall of leaves, and also attacks the branches and stem, causing the plants to die. The injury appears in prolonged dry weather, but is checked by heavy rains, which improve the condition of the plants. The control measures advised are removal and burning of infested tips, spraying with kerosene emulsion or nicotine, or spraying or dusting with sulphur.

Descriptions are also given of the adults of the Lamiids, *Adesmus borgmeieri*, sp. n., which bores in the branches of kapok, and *Gryllica melzeri*, sp. n., the female of which oviposits in and cuts the twigs of *Coccoloba ilheense*.

Ferris (G. F.). **Contributions to the Knowledge of the Coccoidea (Homoptera). VII. Illustrations of fifteen Genotypes of the Diaspididae.**—*Microentomology* **3** pt. 2 pp. 37–56, 15 figs. Stanford Univ., Calif., 1938. **VIII. Illustrations of thirteen Genotypes of the Diaspididae.**—*T.c.* pt. 3 pp. 57–75, 13 figs.

In these papers, which belong to a series [*cf. R.A.E.*, A **24** 565; **25** 264, 516, 626; **26** 184], 15 and 13 genotypes of Diaspine Coccids are illustrated and notes are given on the status of the genera. Both include corrections for earlier ones in the series. A list of generic names ending in "*aspis*" is begun in the first paper and finished in the second, Coccid names being printed in capitals and names used in other groups in ordinary type. The list has been made as full as possible, but is not complete.

Appel (O.). Ed. **Pflanzenschutz. Verhütung und Bekämpfung der Pflanzenkrankheiten.** [Plant Protection. The Prevention and Control of Plant Pests and Diseases.]—In Sorauer (P.). *Handb. Pflanzenkr.* **6,** 4 Aufl., Lief. 3, pp. 577–647 of I. Halbband; pp. 1–208 of II. Halbband, illus., many refs. Berlin, P. Parey, 1939. Price, Germany *Mk.* 17·80; other countries less 25%.

This third part of the sixth volume of Sorauer's text-book [*cf. R.A.E.*, A **26** 703] comprises the conclusion (pp. 577–647) of the section on chemical control, a section on biological control (pp. 1–120 of the 2nd half-volume) and part of a section describing the apparatus used in plant protection work (pp. 121–208).

Nowell (W.). **Internal Boll Disease.**—*Emp. Cott. Gr. Rev.* **16** no. 1 pp. 18–24, 6 refs. London, 1939.

This paper is a review of present knowledge on the relationship between plant bugs feeding on cotton bolls and the injuries, either direct or indirect, for which they are responsible. It is concluded that an early study should be made of the transmission by *Dysdercus* and other bugs of the fungi that cause boll-rots and that a study of the actual mechanism of transmission, though of less immediate importance, is desirable from the scientific point of view.

Subramaniam (T. V.). **Report of Work done in the Entomological Section for the Year 1936–37.**—*Rep. Mysore agric. Dep. 1936–37* pp. 175–178. Bangalore, 1938.

An account is given of work on insect pests in progress at Mysore during the year 1936–37 ; the results of some of the experiments have already been noticed [*R.A.E.*, A **26** 360, 606] ; others confirmed those carried out in previous years [**25** 220, 599]. Larvae of *Diatraea* (*Argyria*) *sticticraspis*, Hmps., on sugar-cane are parasitised by *Apanteles flavipes*, Cam., and those of *Scirpophaga nivella*, F., and *S. monostigma*, Zell., by *Elasmus zehntneri*, Ferrière, *Glyptomorpha* (*Bracon*) *nicevillei*, Bingham, and *Rhaconotus* sp. *Leptispa pygmaea*, Baly, caused serious damage to rice, but was controlled by dusting with a mixture of Paris green and wood ash (1 : 3) and disturbing the plants later to dislodge the beetles. Dusting with Paris green was also effective against *Nymphula depunctalis*, Gn., on rice. Cold-water treatment of rhizomes of banana infested by *Cosmopolites sordidus*, Germ., killed the younger larvae and the adults in the superficial portions, but not the older larvae or the deeply buried adults.

Locusts.—*Rep. imp. Counc. agric. Res. India 1937–38* pp. 91–95. Delhi, 1938.

The results of work on locusts carried out during the year under the auspices of the Locust Committee of the Council are briefly reviewed. Most of the information on breeding and migrations of *Schistocerca gregaria*, Forsk., and *Locusta migratoria*, L., has been summarised elsewhere [*cf. R.A.E.*, A **26** 628]. It is concluded that if the rains in the Indian desert had not been interrupted between July and September 1937, the breeding of *S. gregaria* might have led to concentrations of locusts, which in the event of favourable winter rains at Mekran, might have initiated a new locust cycle. In actual fact, there were no overwintering locusts in the Jaisalmer-Bikaner areas, though they were numerous in the Thar Mallani area (where the September rainfall had been especially good) and on the coasts of Lasbela and Mekran. Here the winter rains were good, and extensive breeding in the spring of 1938 was expected. Large numbers of hoppers of *L. migratoria* were reported damaging cereals and sugar-cane in the Sirohi and Baroda States in October–November 1937, but they had reached the adult stages and disappeared by November.

The mapping of locust data in India for the years 1889 to 1925 was concluded during the year.

Western Australia. **Annual Report of the Operations of the Department of Agriculture for the Year ended 30th June, 1938.**—33 pp. Perth [W.A.], 1938.

It is stated in the course of this report (p. 23) that during the year under review, an outbreak of *Austroicetes cruciata*, Sauss. (*jungi*, Branc.) occurred in Western Australia for the fourth successive year [*cf. R.A.E.*, A **25** 296, 634 ; **26** 169], and was more extensive than any previously experienced. Encouraging results in control work were obtained with a bait of bran molasses and sodium arsenite [**26** 170] or failing this, bran, brown sugar and white arsenic, and fallowing

operations begun during the previous year [*cf.* **25** 634] were successfully continued. The total expenditure on control, which prevented heavy losses in most districts, was £22,000.

The red-legged earth mite [*Halotydeus destructor*, Tucker] [**27** 131] was again a serious pest in pastures. The lucerne flea [*Smynthurus viridis*, L.] still causes serious damage to clover pastures, but in recent years, losses have been smaller where the Bdellid mite [*Biscirus lapidarius*, Kramer] has become well established [**24** 134]. Twenty colonies of the egg parasite [*Microphanurus basalis*, Wollaston (*megacephalus*, Ashm.)] of the green bug [*Nezara viridula*, L.] were distributed. The parasite is well established [*cf.* **23** 76] and is a potent factor in the control of the bug.

STRICKLAND (A. G.). **Red Scale of Citrus in South Australia.**—*J. Dep. Agric. S. Aust.* **42** no. 4 pp. 387–393, 6 figs. Adelaide, 1938.

A brief account is given of the bionomics and control of *Aonidiella aurantii*, Mask., the most destructive pest of *Citrus* in South Australia, where its life-history is similar to that recorded in Victoria [*R.A.E.*, A **26** 85]. The recently introduced methods of ridding harvested fruits of Coccids by brushing or subjecting them to a jet of water at high pressure injure the rind and impair the keeping qualities of the fruit. In field experiments carried out in South Australia in 1936 to determine the effectiveness of a programme in which spraying with white-oil emulsion (1 gal. concentrate in 40 gals. water) was followed by fumigation with hydrocyanic acid gas, trees were sprayed on 12th February and fumigated on 3rd March. The combined treatment gave better results than fumigation alone or an application of the spray on 12th February, alone or followed by a second on 28th April, the percentage of dead Coccids on the fruit and foliage of treated plants being 99·0 and 100·0, 96·9 and 98·2, 58·4 and 83·2, and 67·0 and 90·3, respectively. The poor results obtained from the double spray treatment were probably due to the lateness of the applications [*cf. loc. cit.*]. Counts of Coccids on the fruit and foliage during the following season showed that the beneficial results of the treatments persisted, the order of efficiency being maintained.

An application of white-oil emulsion followed two weeks later by fumigation is recommended where infestation is severe; for light attacks, fumigating or spraying once may be effective, but better results are given by double spraying in December and January.

KEMP (H. K.). **The Apple Leaf Jassid in South Australia.**—*J. Dep. Agric. S. Aust.* **42** no. 4 pp. 394–401, 6 figs. Adelaide, 1938.

The Jassid, *Typhlocyba froggatti*, Baker (*australis*, Frogg.), has become common on apple in South Australia during the last three or four years. Its food-plants include apple, quince, plum, wild and cultivated hawthorn [*Crataegus*], and, occasionally, pear. The damage it causes to fruit and foliage is described, and an account of its life-history in New Zealand is quoted [*R.A.E.*, A **22** 656]. It probably has three generations a year in South Australia. It can be controlled by spraying with nicotine sulphate (1 : 800), alone or in combination with lead arsenate [**24** 787] or lime-sulphur; the importance of timing the applications correctly [**22** 656] is stressed.

Miller (L. W.). **Codling Moth and Williams Pears. Goulburn Valley Investigations.**—*J. Dep. Agric. Vict.* **36** pt. 11 pp. 545–561, 572, 8 figs., 4 graphs, 2 refs. Melbourne, 1938.

Investigations on the life-history and control of *Cydia pomonella*, L., on pears were continued in Victoria during 1937–38. In the laboratory three generations occurred [*cf. R.A.E.*, A **26** 168], and 5·56, 22·22 and 88·31 per cent. of the larvae of the first, second and third generations overwintered. A few third-generation adults emerged, but they did not oviposit. The emergence of adults of the overwintered generation began on 27th September, 15 days earlier than in 1936. In the orchard there were also three generations, the first and second generations overlapping in late January, and there was no indication of third-generation adults. The first moths were trapped on 27th September. Molasses and golden syrup were more attractive than vinegar, the total number of moths caught between late September and late February in 9 traps baited with each of the three solutions being 797, 684 and 320, respectively.

With 2 calyx and 2 cover sprays of lead arsenate at rates of 3, 5 and 8 lb. paste to 80 gals. water, respectively, the percentages of pears infested (including both picked and fallen fruit) were 11·53, 8·12 and 6·04. When summer oil was added at rates of 1 pint and 1 gal. to the spray containing 5 lb. lead arsenate paste, or substituted for it at the rate of 1 : 60 in the two cover sprays, the infestation percentages were 6·43, 3·83 and 6·6, respectively. One calyx and two cover sprays of 5 lb. lead arsenate paste in 80 gals. water gave 9·58 per cent. infestation when the calyx spray was applied early and 13·9 when its application was delayed until the peak activity of the moths of the overwintered brood. In these tests a difference of 2·295 in percentage infestation was significant. The arsenic residue resulting from the different schedules varied from 0·006 to 0·4 grain As_2O_3 per lb. fruit, the only programme that gave residues below the prescribed limit of 0·01 being the one in which lead arsenate was not used in the cover sprays.

In experiments on banding, the best results were obtained by applying two bands per tree, one of hessian cloth and one of corrugated cardboard treated with beta-naphthol, the average number of larvae trapped during the season being 63·2. When one band was applied per tree, the average numbers of larvae trapped were 41 in hessian bands, 19·8 in treated bands left in place throughout the season, and 15·2 of the first generation and 6 of the second in treated bands renewed after the first-generation larvae had spun their cocoons. The percentage mortality among larvae trapped by the chemically treated bands was 97·5 ; larvae in hessian bands were removed and destroyed each week.

Pupae of *C. pomonella* were parasitised by the Ichneumonid, *Gambrus stokesi*, Cam., and the larvae by a Chalcid identified as *Stomatoceras pomonellae*, Cam., which parasitises *C. molesta*, Busck, near Sydney.

Noble (N. S.). *Euplectrus agaristae* **Craw., a Parasite of the Grape Vine Moth** (*Phalaenoides glycine* **Lew.**)—*Sci. Bull. Dep. Agric. N.S.W.* no. 63, 27 pp., 9 figs., 33 refs. Sydney, 1938.

In this paper are described in detail the egg, larva and adults of both sexes and the bionomics of *Euplectrus agaristae*, Crwf., an ectoparasite of

the Agaristid, *Phalaenoides glycinae*, Lewin, that attacks grape vines in New South Wales. Much of the information on its bionomics is identical with that in a paper already noticed [*R.A.E.*, A **25** 294]. From eggs laid on a host larva in the laboratory by an unfertilised female, 25 adults developed, all of which were males. Pupae of *E. agaristae* that were observed on a host larva in the autumn of 1935 and that failed to give rise to adults were found to have been parasitised by an unidentified Eulophid that pupated in them and overwintered in the adult stage.

HARDY (G. H.). **Notes on Australian Muscoidea III. Dexiinae, Phasiinae, some Tachininae and Appendix.**—*Proc. roy. Soc. Qd* **49** (1937) pp. 53–70. Brisbane, 1938.

In the course of this paper, the author proposes the names *Palpostoma aldrichi*, for the parasite of *Lepidoderma albohirtum*, Waterh., in Queensland that Aldrich identified and described as *P. testacea*, R.-D. [*R.A.E.*, A **11** 126], and *Tritaxys braueri* for the Tachinid that Brauer and Bergenstamm identified as *T.* (*Blepharipeza*) *goniaeformis*, Macq., and made the type of their genus *Anamastax*. *T. braueri* is a parasite of *Cirphis unipuncta*, Haw., in Queensland, while *T. goniaeformis* is apparently confined to Tasmania.

GIRAULT (A. A.). **Descriptions of a few new Parasites of Pests, Australian mostly.**—*Qd Nat.* **10** no. 4 pp. 74–77. Brisbane, 1938.

The new species described include the Eulophid, *Apleurotropis lalori*, reared from *Promecotheca* on coconut in the Territory of New Guinea, and the Pteromalid, *Muscideopsis lecanii*, from *Lecanium persicae*, F., in Western Australia.

MALLOCH (J. R.). **Trypetidae of the Mangarevan Expedition (Diptera).**—*Occ. Pap. Bishop Mus.* **14** no. 7 pp. 111–116. Honolulu, 1938.

These records of Trypetids from south-eastern Polynesia include *Dacus psidii*, Froggatt, from fruits of guava and *Inocarpus edulis* in the Society Islands.

CASTAGNE (E.). **Contribution à l'étude chimique des légumineuses insecticides du Congo Belge.**—*Mém. Inst. roy. colon. belge* **6** fasc. 3, 102 pp. illus. Brussels, 1938.

In the first part of this paper, the author recapitulates various methods of determining the contents of rotenone and other constituents in insecticidal plants, and in the second he describes and illustrates a number of plants of the genera *Tephrosia*, *Lonchocarpus*, *Milletia* and *Derris*, many of which are now being cultivated commercially in the Belgian Congo, giving the chemical analyses of locally grown samples. The species of *Derris* that have the highest rotenone content are *D. elliptica* and *D. malaccensis*.

SEYDEL (C.). **La teigne des cornes** (*Tinea vastella* **Zell.**).—*Bull. Cerc. zool. congol.* **15** pp. (54)–(56), 2 figs. Brussels, 1938.

Horns of big game obtained in any part of the Belgian Congo are liable to be riddled with holes by the larvae of *Tinea vastella*, Zell.,

which may destroy them completely. Brief descriptions are given of the larva, pupa and adult.

After they have been cleaned, horns should be given a coat of colourless spirit varnish to protect them from attack. If they are already infested, all the cocoons, which protrude from the holes, should be removed. Living larvae should be killed by means of kerosene or petrol injected into their holes, which should then be plugged with a mixture of beeswax and lamp-black before the horns are varnished.

WILSON (G. F.). **Insect Pests of Rhododendrons : their Distribution in Britain.**—*Proc. R. ent. Soc. Lond.* (A) **14** pt. 1 pp. 1–5, 2 maps, 7 refs. London, 1939.

Insect pests of rhododendron in Great Britain include the Tingid, *Stephanitis rhododendri*, Horv. [*R.A.E.*, A **24** 549], the Aleurodid, *Dialeurodes chittendeni*, Laing [**17** 257], certain Tortricids, and the weevils, *Otiorrhynchus sulcatus*, F., and *O. singularis*, L. Infestations by *S. rhododendri* are accompanied by either brown or white mottling of the leaves, according to the type of feeding [*cf.* **25** 612]. Plants growing in open sunny positions are most liable to attack. Outbreaks of *D. chittendeni*, which is sometimes abundant on plants in dense shade, have been reported from 25 localities in southern England, but not from other parts of the British Isles. Maps are given showing the British distribution of these two insects. Several Tortricids, including oak-feeding species, have become adapted to a diet of rhododendron, even in the presence of their normal food-plants. The larvae of *Tortrix viridana*, L., and some other species, however, do not feed on the leaves, but roll them to provide pupation quarters. The adults of *O. sulcatus* and *O. singularis* attack the foliage, the former feeding on the leaf-margins and the latter on the tissue between the veins and on the midribs ; the petioles may be completely girdled, causing the leaf to wilt and snap off in high winds. Rhododendrons in the shade of oak, birch and pine woods are particularly liable to infestation by both Tortricids and *Otiorrhynchus*. Lists are given of the rhododendrons most frequently attacked by each pest, and of those that are immune from some of them.

WAKELY (S.). **Notes on *Pyrausta nubilalis*, Hubn.**—*Ent. Rec.* **51** no. 1 pp. 3–5, 2 refs. London, 1939.

Larvae from eggs laid by two of the females of *Pyrausta nubilalis*, Hb., taken in Essex in July 1938 [*R.A.E.*, A **27** 116] burrowed into hop stems. On 8th October, larvae were found in stems of *Artemisia vulgaris* in the same district. Brief notes are given on the history and importance of the moth as a pest of maize in the United States and Canada, with records of some of its food-plants there and in Europe.

MALENOTTI (E.). **Osservazioni del 1938—XVI, sulla piralide e la sesamia del sorgo e del mais in Italia.** [Observations in 1938 on *Pyrausta nubilalis* and *Sesamia cretica* infesting Sugar Sorghum and Maize in Italy.]—*Industr. saccar. ital.* **31** no. 12 repr. 14 pp., 2 figs., 11 graphs. Genoa, 1938.

The results are given of investigations in Italy in 1938 on the infestation of sugar sorghum and maize by *Pyrausta nubilalis*, Hb., and *Sesamia cretica*, Led. [*cf. R.A.E.*, A **27** 198] with particular

reference to the spring emergence of adults of the overwintering generation. The method consisted in noting the emergences from stems of maize and sorghum, the observations being made on batches of 1,000 stems in 11 localities. In four of these, however, only maize was available and *Sesamia* was absent, and in two of the others, in which both food-plants occurred, only one of the moths was present. The results, which are illustrated by graphs, showed that neither of these moths appeared to prefer sorghum to maize, but this may depend on cultural conditions. Adult emergence began in both species a few days earlier from sugar sorghum than from maize, but the duration of the emergence period was not influenced by the food-plant. In most localities, the peak of emergence was in mid-June. Contrary to expectation, emergence in northern Italy occurred at about the same time as in southern districts, probably owing to a very cold spring in the latter in 1938. In northern Italy, the greatest damage by *Pyrausta* to maize is caused by larvae of the first generation. Those of the second generation, which is partial, occur in August, and although maize is then resistant to attack, sorghum is not. No large-scale method of control is available against second-generation larvae, and although both species are parasitised by species of *Pimpla* and by Tachinids, the control thus afforded is slight. The destruction of the stalks is the principal control measure in the case of maize, but in that of sugar sorghum, the stalks of which are utilised at an early date, it suffices to ensure that the stubble is well ploughed under to prevent its becoming a source of infestation in the following year. Observations in one locality showed that late sorghums were less attacked than early ones.

MELIS (A.). **Contributo alla conoscenza della cecidomia delle foglie del pero** (*Perrisia pyri* **Bouché**). [A Contribution to the Knowledge of the Pear Leaf Midge, *Dasyneura pyri*.]—*Redia* **24** pp. 219–283, 23 figs., 2 pls., 25 refs. Florence, 1938.

Dasyneura (*Perrisia*) *pyri*, Bch., all stages of which are described in detail, causes considerable injury to pear in central and northern Italy. An account is given of its bionomics in Tuscany, where it has six generations a year, the information being compared with that in the literature. In normal years the first adults emerge at the end of March or beginning of April. They pair at once and females, which were more numerous than males, oviposit in the median groove formed by the two still unfolded halves of the very young leaves. The larvae hatch in 3–4 days and feed on the leaves, causing deformation. From 2 to 30 larvae have been observed on a leaf. The larvae drop to the ground in 10–12 days and pupate at a depth of 2–4 ins. The duration of the pupal period varies with temperature and soil moisture. The second generation develops in April–May, the third in May–June, the fourth in June–July, the fifth in July–August, and the sixth in August–September. Larvae of the fourth generation diapause for about a month before pupating. The pupae of the sixth generation usually hibernate, but sometimes a partial seventh generation occurs. The parasites of *D. pyri* observed by the author were a species of *Platygaster* and two Entedonine Eulophids, one of which belonged to the genus *Derostenus*. All three parasitised the larvae, but *Derostenus* was infrequent. Parasitism by *Platygaster* was highest in larvae of the fourth and fifth generations. The host larvae entered the ground

as usual, the adult Scelionids emerging about 15 days later. The undetermined Entedonine was the most effective parasite, the adults appearing at the end of March or early in April. First- and second-generation larvae were parasitised, those of the first very slightly (up to 10–20 per cent.) and those of the second very heavily (up to 95–97 per cent.). The slight infestation by *D. pyri* in 1937 in Tuscany is ascribed to this parasite. The control measures advocated are the collection and destruction of infested leaves and the cultivation of the ground in winter. If heavy mineral oils are applied against other pear pests, such as *Epidiaspis leperii*, Sign. (*Diaspis piricola*, Del G.), the oil dropping from the trees kills pupae turned up by soil cultivation.

THIEM (H.). **Ueber den Stand der Bekämpfung der Kirschfruchtfliege (*Rhagoletis cerasi* L.).** [On the Position of Control of the Cherry Fruit Fly, *R. cerasi*.]—*Int. Kongr. Ent.* **7** (2) preprint 15 pp., 1 graph. Berlin, 1938.

The author discusses climate and alternative food-plants as factors in the distribution and abundance of *Rhagoletis cerasi*, L., on cherry in Germany and describes experiments with a number of possible control methods. Destruction of the pupae in the ground is difficult and uncertain, and experiments against them with tar distillates, pyridin and tetrachlorethane did not give reliable results; the tar distillates were the most effective, the medium-oil type proving superior to the heavy oil [*R.A.E.*, A **25** 3] and a good substitute for tetrachlorethane [**23** 125]. Similar treatment against pupating larvae [**22** 248] is only occasionally of value. Attempts to destroy the eggs in the fruit are unlikely to prove successful, and tests made with various preparations of derris, pyrethrum and nicotine gave negative results. Of 89 substances tested for attractiveness to the adults, including various extracts of cherry and *Lonicera*, none was of any value. Coloured glass plates and lights also failed to attract them to any significant degree. When various dusts were tested to kill the adults emerging from the ground, Detal, containing 10 per cent. dinitro-o-cresol, gave the best results on dry ground (killing 54 out of 56 flies when applied at the rate of nearly 1 oz. to 4 sq. yards), but failed on wet ground. Dusting or spraying the crowns of the trees with several insecticides, including dinitro-o-cresol, proved ineffective. It is concluded that no satisfactory control measure against *R. cerasi* is available. Preventive measures, such as cultivation of the soil, early picking of cherries, grafting of early maturing varieties, replacement of susceptible varieties by others, and the removal of *Lonicera* and *Prunus avium* from sweet-cherry districts are of some use, but depend on local conditions.

THIEM (H.). **Quassia als wirksames Mittel zur Bekämpfung der Pflaumensägewespen (*Hoplocampa minuta* Christ und *Hoplocampa flava* L.).** [Quassia as an effective Insecticide against the Plum Sawflies, *H. minuta* and *H. flava*.]—*Int. Kongr. Ent.* **7** (2) preprint 19 pp., 7 figs. Berlin, 1938.

Work is reviewed showing that quassia extract is effective against *Hoplocampa minuta*, Christ, and *H. flava*, L., attacking plum in Germany [*cf. R.A.E.*, A **25** 465; **27** 46; etc.]. Newly hatched

larvae of *Bombyx mori*, L., are also killed by contact with surfaces that have been sprayed with quassia, and a method is described for testing the qualities of extracts on them. It was found in this way that prolonged extraction with water is necessary to exhaust all the quassin from quassia chips, and that commercial preparations of quassia vary in insecticidal value. Tests with young larvae of *Cydia pomonella*, L., and vine moths showed them to be insensitive to quassia.

THIEM (H.). **Untersuchungen zur Bekämpfung des Apfelblütenstechers (*Anthonomus pomorum* L.).** [Investigations on the Control of the Apple Blossom Weevil.]—*Forschungsdienst* **6** pt. 12 pp. 585–597, 7 refs. Berlin, 1938.

While a loss of 50 per cent. of the blossoms of apple as a result of infestation by *Anthonomus pomorum*, L., may be disregarded when blossoms are plentiful, loss caused by the weevil increases in importance in years in which blossoms are scarce or the fruits are destroyed by other pests. In some orchards in Germany, especially those adjoining pine forests, nearly all the apple blossoms are destroyed, the cracks in the bark of the pines providing hibernation quarters for many weevils. The best time for applying control measures is in early spring during the period of maturation feeding on the buds, and the results are given of experiments with various proprietary insecticides made in the spring of 1937 and 1938. Detal dusts containing dinitro-ortho-cresol (5 and 10 per cent.) and a dust containing derris and pyrethrum were effective, the former being superior. The best results with the latter were obtained by abundant dusting of the trunk and crown after the migration of most of the weevils to the tree. The dinitro-ortho-cresol dusts retain their toxicity longer and are effective against weevils arriving on the trees for some time after application. Sprays containing derris and pyrethrum in combination and a tar distillate of the Baumspritzmittel type [*R.A.E.*, A **24** 797] were not satisfactory, since they do not give effective control unless they come in direct contact with the majority of the weevils at the moment of application.

MERKEL (L.). **Amtliche Pflanzenbeschau im Freihafen.** [Official Plant Inspection in 1937 in the Free Port of Hamburg.]—*Jber. Inst. angew. Bot. Hamburg* **55** (1937) pp. 88–99. Hamburg, 1938.

HAHMANN (K.). **Abteilung für Pflanzenschutz.** [Plant Protection Division.]—*T.c.* pp. 100–119.

The first of these two reports includes records of insect pests of fruits and plants intercepted in the free port of Hamburg, and the second notes on the plant diseases and pests observed in or near Hamburg in 1937.

NOLTE (H. W.). **Die Widerstandsfähigkeit der Spiegelraupen der Nonne (*Lymantria monacha* L.) gegen Kälte.** [The Resistance to Cold of the grouped Larvae of the Nun Moth.]—*Anz. Schädlingsk.* **15** pt. 1 pp. 11–12, 1 ref. Berlin, 1939.

No decrease in infestation of forests in Germany by *Lymantria monacha*, L., was observed to follow a cold spell that succeeded warm weather in April and May 1938, when the larvae were hatching or

were newly hatched. In view of von Arnim's observations on the effect of cold on the larvae [*R.A.E.*, A **24** 340], the author carried out investigations on the resistance of newly hatched larvae to a temperature maintained between −1 and −2°C. [30·2–28·4°F.]. The larvae were kept in Petri dishes in a refrigerator, and all those exposed for up to 6 days resumed normal development when returned to laboratory temperature and placed on larch twigs. Of larvae kept in dry Petri dishes, 40 per cent. died after 13 days exposure and of those kept on moist filter paper in the dishes, 39 per cent. died after 10 days. After longer exposures more than half the larvae died, and after 15 days the few survivors failed to complete the first instar. Conditions are far less severe in nature than in these tests.

Schwerdtfeger (F.). **Verhinderung der Eiablage als Schutzmassnahme gegen den Maikäfer?** [Prevention of Oviposition as a protective Measure against May Beetles?]—*Z. Forst- u. Jagdwesen* **70** pt. 1 pp. 51–59. Berlin, 1938.

Possible methods of preventing females of *Melolontha* from ovipositing in land to be used for crops were investigated in Prussia in the flight years 1934 and 1936, *M. hippocastani*, F., being the predominant species. The use as repellents of unslaked lime, tar distillate, salt, naphthalene and several other substances each applied once, and of smoke from smudge fires, did not give promising results. Very few eggs were laid in ground that was well worked and kept free from vegetation during the flight period [*cf. R.A.E.*, A **26** 250], and it is suggested that this is one method of real value.

Thiem (H.). **Zur Lage und Gestaltung der Maikäferbekämpfung.** [The Position and Future of May Beetle Control.]—*Int. Kongr. Ent.* **7** (2) preprint 20 pp., 5 pls. Berlin, 1938.

Organised collection of the adults is the recognised measure against *Melolontha* spp. in Germany, but it is attended by many practical difficulties, especially in forests. The adults feed on the leaves of deciduous trees. Oaks are preferred, and outbreaks are unlikely in regions from which mixed forests of oak and beech are absent. The larvae attack young plantations in forests, but chiefly infest crops in fields adjoining mixed forests of oak and beech.

The author briefly discusses various measures that have been advocated against the adults and larvae, and describes experiments on the effectiveness against the adults of proprietary preparations containing dinitro-o-cresol. In preliminary laboratory tests in 1937, a dust containing 2·5 per cent. dinitro-o-cresol killed all beetles to which it was applied directly or which were placed on dusted surfaces. Sprays at concentrations of 0·1–0·2 per cent. gave complete mortality when applied directly to the adults, and at 0·05 per cent. resulted in about 60 per cent. mortality. In June 1938, mixed forests were dusted by aeroplane with a dust containing 10 per cent. dinitro-o-cresol at the rate of 36 lb. per acre in moderately warm weather. The percentage mortality on the following day was 93·5. In another forest district, a preparation containing 10 per cent. dinitro-o-cresol applied by means of power dusters at the rate of 72–90 lb. per acre gave good control. For small, discontinuous areas power dusters are preferable to the aeroplane. A few small-scale

field experiments made with a spray solution containing about 0·3 per cent. dinitro-o-cresol, which gave considerable mortality, indicated that spraying is a useful additional measure. It is considered preferable to dusting in the case of trees in streets, avenues, parks and hedges [*R.A.E.*, A **27** 171]. Owing to the injury to the leaves, dusting or spraying with dinitro-o-cresol is not suitable in orchards, but beetles jarred from the fruit trees can be killed in a solution of it.

SCHWERDTFEGER (F.). **Ueber den Einfluss der Winterkälte auf den Maikäferengerling.** [On the Influence of Winter Cold on the Larva of the May Beetle.]—*Z. PflKrankh.* **49** pt. 2 pp. 95–106, 4 figs. Stuttgart, 1939.

The experiments described were made in January and February 1935 with larvae of *Melolontha* collected in Prussia in the previous autumn. Larvae in the early instars became inactive at 6·3°C. [43·34°F.]. Numbness due to cold occurred in the first instar at temperatures below 0·5°C. [32·9°F.] and in the third instar between −1·2 and −2·5°C. [29·84 and 27·5°F.]. Death supervened between −3·2 and −5·2°C. [26·24 and 22·64°F.], and −4°C. [24·8°F.] may be regarded generally as the lethal temperature. The relatively high temperature at which the early instars became inactive would prevent larvae in position in the ground for hibernation from moving to a greater depth to escape increasing cold. This appears to be the reason for their normally hibernating at a depth of 19–24 inches, at which the lethal temperature is hardly ever reached.

In a hibernation experiment with larvae of *Melolontha melolontha*, L., and larvae and adults of *M. hippocastani*, F., in which the winter temperatures were mild and a mortality of about 20 per cent. occurred owing to infection with fungi and bacteria, it was observed that the bacteria killed more larvae of both species than the fungi, while the contrary was the case with the adults.

BRAMSTEDT (F.). **Die Bekämpfung der Obstmade durch Verwendung von Giftködern gegen den Falter.** [Control of *Cydia pomonella* by the Use of Poison Baits against the Adults.]—*NachrBl. dtsch. PflSchDienst* **19** no. 2 pp. 10–12, 12 refs. Berlin, 1939.

In view of Böhmel's investigations [*R.A.E.*, A **26** 50] and the fact that adults of *Cydia* (*Carpocapsa*) *pomonella*, L., in the laboratory were observed to feed on dried poison baits, the author investigated the effect of bait-sprays against them at Naumburg, Germany, in the summer of 1938. Such baits should be of value in preventing oviposition, as the author found that the females do not begin to oviposit until 2–4 days after emergence, whereas they feed copiously on the first day. Moreover, of 91 moths caught in traps baited with molasses and used as indicators of adult emergence, the 61 females comprised 12 that had laid their eggs, 6 that had begun ovipositing and 43 with full ovaries. Two poison baits were tested, one consisting of a derris preparation at a concentration of 1 per cent. with 0·15 per cent. soft soap and 4 per cent. sugar, and the other of 0·4 per cent. lead arsenate with 4 per cent. sugar. In laboratory and field cage tests, the adults died within 5 days when they were placed in the cage immediately after the poison bait had dried. Moths confined with the poison 1–4 days after it had dried died within 9 days in the laboratory and

11 days in the field. None of the poisoned moths recovered. In an experiment in an apple orchard sprayed three times, sections of 83, 317 and 36 trees were sprayed, respectively, with the arsenical bait, the derris bait, and the normal arsenical spray directed against the larvae. The percentages of uninfested apples from the three sections were 62, 67 and 49, respectively, while only 11 per cent. of the apples from an unsprayed orchard about 550 yards away were uninfested. No danger is likely to accrue to bees from the use of derris bait sprays.

PROFFT (J.). **Wanderungen und Flüge der Pfirsichblattlaus—Ausbreitungsmöglichkeiten der Kartoffelvirosen.** [The Migrations and Flights of *Myzus persicae*. The Possibilities of Spread of Potato Virus Diseases.]—*NachrBl. dtsch. PflSchDienst* **19** no. 2 pp. 14–15, 8 refs. Berlin, 1939.

The migrations and flights of *Myzus persicae*, Sulz., a vector of several virus diseases of potato, are discussed from the literature. Winged Aphids have been occasionally found on islands 36 miles from the North Sea coast of Germany, and in Spitzbergen, hundreds of miles from their normal habitat. There is some evidence that Aphids are guided, at least over short distances, by a sense of smell; young potato plants are especially attractive to winged migrants of *M. persicae*, and isolated plants become infested [*R.A.E.*, A **26** 379]. Potato fields on high, exposed situations are less infested than those in low, sheltered ones, and consequently, positions exposed to winds should be chosen for growing plants that it is desired to protect from virus infection.

GEIJSKES (D. C.). **Beiträge zur Kenntnis der europäischen Spinnmilben. (Acari, Tetranychidae), mit besonderer Berücksichtigung der niederländischen Arten.** [Contributions to the Knowledge of European Spinning Mites, with particular Reference to the Netherlands Species.]—*Meded. LandbHoogesch. Wageningen* **42** pt. 4 68 pp., 44 figs. Wageningen, 1939.

This systematic study of Tetranychid mites, which is based on the work of Oudemans, contains a description of important morphological characters, brief notes on biology, a key to the European genera, in some cases keys to species occurring in Europe or in Holland, or lists of the former, and descriptions of all the species occurring in Holland, and of the type species of European genera not represented in that country. The new species described from Holland are *Bryobia sarothamni* on broom (*Sarothamnus vulgaris*), *Tenuipalpus phoenicis* on *Phoenix* sp. in a greenhouse, and *T. oudemansi* on apple in an orchard and a beech leaf.

MENOZZI (C.). **Il punteruolo della barbabietola** (*Conorrhynchus* (*Cleonus*) *mendicus* **Gyll.) e mezzi pratici per combatterlo.** [The Beet Weevil, *Conorrhynchus mendicus* and measures for its control.]—12 pp., 5 figs. Ferrara, Consorz. naz. Prod. Zucch., 1939.

A popular account is given of the morphology and bionomics of the weevil, *Cleonus* (*Conorrhynchus*) *mendicus*, Gylh., which causes considerable injury to sugar-beet in Italy, of its natural enemies, and of cultural, chemical and other measures for its control [*cf. R.A.E.*, A **18** 561, 562, etc.].

Lloyd (D. C.). **A Study of some Factors governing the Choice of Hosts and Distribution of Progeny by the Chalcid** *Ooencyrtus kuvanae* **Howard.**—*Philos. Trans.* (B) **229** no. 561 pp. 275–322, 12 figs., 26 refs. London, 1938.

The following is taken from the author's summary: The present work attempts to determine the factors involved in the selection of hosts (eggs of *Lymantria* (*Porthetria*) *dispar*, L.) by *Ooencyrtus kuvanae*, Howard, and examines the distribution of the eggs of this parasite in a restricted environment such as obtains when the females are kept in immediate contact with the host eggs in Petri dishes. It is shown that the distribution of the eggs by the parasite is not at random, but has reference to the nature of the available hosts. The female usually selects unparasitised hosts, and if forced to superparasitise, chooses the hosts that contain the youngest parasite stage. It is suggested that the graded oviposition response of the females towards hosts containing advancing developmental stages of the parasite may be conveniently correlated with the decreasing quantity of actual host material present within the host egg-shell rather than with a quantitative increase in intensity of movements of parasite larvae, etc. This is supported by the fact that hosts containing dead second and third instars of the larvae are rejected to an extent comparable with hosts containing similar live larval instars. However, as a decreasing host quantity is accompanied by corresponding maturing parasite stages, the characters of these latter are also of significance. If only parasitised hosts are accessible, the female tends to retain her eggs rather than deposit them. The exercise of this restraint is shown to be related to the developmental stage of the parasite in the parasitised host, the age and condition of the ovary of the female, and the number and nature of the hosts available. It is suggested that the incidence of superparasitism in the field cannot be referred to any single constant cause, but will depend, among other things, upon the frequency of contact with the particular type of hosts.

Summary of the Scientific Research Work of the Institute of Plant Protection for the Year 1936. Part III. Viruses and Bacterioses, Biological Method, Chemical Method and Mechanisation. [*In Russian.*]—Med. 8vo, 111 pp., 3 graphs, 7 figs., 2 refs. Leningrad, Lenin Acad. agric. Sci., 1938. Price 4 *rub.* 35 *kop.*

This part of a collection of summaries of reports on work in the Russian Union in 1936 [*cf. R.A.E.*, A **26** 422, 470] comprises the following sections: Virus and bacterial Diseases of Plants (pp. 3–50); Biological Method of controlling Pests and Diseases of Crop Plants (pp. 51–63); Biological Control with fungous and bacterial Diseases (pp. 64-77); Chemical Methods of controlling Pests and Diseases of Crop Plants (pp. 78–95); and Mechanisation of Methods of Plant Protection (pp. 96–108), which deals with spraying and dusting equipment. The following summaries deal with pests or insecticides:

Krivin (B. G.). **Properties of the Peach Aphis in Relation to Potato Viruses,** pp. 22–25. In experiments in Moscow, healthy individuals of *Myzus* (*Myzodes*) *persicae*, Sulz., placed on diseased potato plants and then transferred to healthy potatoes and tobacco, transmitted viruses producing crinkle, streak, leaf-roll and spot. The resulting symptoms

usually resembled those observed in the initially diseased plants, but in some instances mixed infections were produced. In the case of tobacco, the symptoms of the diseases transmitted by the Aphids were less pronounced than those artificially produced by inoculation of the sap of diseased plants or those in naturally infected potatoes. In special comparative experiments with Virginia and Turkish tobacco, Y-virus transmitted by the Aphid produced only a slight infection, whereas a strain obtained from England retarded the development of the plants and usually killed them. It appears that there are several strains of Y-virus that differ considerably in virulence, and experiments should be carried out with *M. persicae* and other insects to determine which types are prevalent and important in the Russian Union, with a view to breeding resistant varieties of plants.

Krivin (B. G.). **Possible Carriers of Potato Viruses in the Moscow Region,** pp. 25–27. Field observations in the Province of Moscow on the damage caused to potatoes by Jassids, Capsids and a Pentatomid showed that these Rhynchota definitely preferred certain varieties to others in the same plot. A list of 14 varieties is given, showing the degree of the damage caused to each. In experiments with *Lygus pratensis*, L., and the Aphid, *Macrosiphum* (*Aulacorthum*) *pelargonii*, Kalt., collected in the field on potato plants naturally infected with crinkly mosaic and placed on healthy plants of potato and Virginia tobacco, only potatoes became infected, some of the plants on which the Aphids were placed showing symptoms of leaf-roll and leaf-spot, and some of those infested with the Capsid developing leaf-roll. A study should therefore be made of these two insects as carriers of virus diseases of potatoes in central Russia ; another possible vector is the Jassid, *Macrosteles* (*Cicadula*) *sexnotata*, Fall., which is known to transmit several diseases of plants.

Popova (E. I.). **The combined effect of Predators and of Parasites on the Development Dynamics of the San José Scale** (*Aspidiotus perniciosus* **Comst.),** pp. 51–52. Of predators attacking *Aspidiotus perniciosus*, Comst., in the Slavyansk district of the Region of Krasnodar in 1936, the chief was *Chilocorus renipustulatus*, Scriba. Under experimental conditions, one individual destroyed a mean of 18·2 females and 9·5 larvae of the Coccid in 24 hours. Systematic counts at intervals of 6 days of the numbers of *Aspidiotus* and *Chilocorus* present in all stages on selected sections of apple trees of different varieties showed the existence of peaks in the activity of *Chilocorus* at the beginning of June and in late July and early August. The Coccid was scarce from May to mid-July and again at the beginning of August and in September, but became abundant in the second half of July and at the end of August. The reduction in numbers of the Coccid is due chiefly to the activity of *Chilocorus*, but the latter is considerably checked by parasites, up to 52 per cent. of the larvae and pupae being parasitised in 1936. No parasites of the Coccid were observed.

Bogunova (M. V.) & Telenga (N. A.). **The Use of different Species of** *Chilocorus* **for controlling San José Scale in the Caucasus,** pp. 52–54. With a view to controlling *Aspidiotus perniciosus*, Comst., in the Caucasus, the Coccinellid, *Chilocorus renipustulatus* ab. *inornatus*, Weise, was brought from the Russian Far East and released in Sukhum in 1935 [*cf.* **25** 399]. The adults hibernated, and resumed activity

between 7th May and 10th June 1936. They had completed oviposition by mid-June. There were three generations during the year, but the second and third were partial. The duration of development of the first generation averaged 55 days at 18–19°C. [64·4–66·2°F.] and that of the second 26 days at 24–25°C. [75·2–77°F.]. An adult devoured an average of 22½ scales daily, and a larva destroyed 334 during its development. The adults of the indigenous Coccinellids, *C. renipustulatus*, Scriba, and *C. bipustulatus*, L., appeared between 26th May and 1st July, and 29th May and 15th July, respectively; there were two complete generations during the year and a partial third. The developmental period of the first and second generations averaged 58 and 25 days for *C. renipustulatus* and 62·5 and 31·5 days for *C. bipustulatus*. Overwintered females of the former oviposited until about 20th July and those of the latter until the end of the month. The oviposition periods of females of the second generation of all the three Coccinellids lasted 1½–2 months and ended in the first half of September, when the temperature at night dropped to 13–15°C. [55·4–59°F.]. The eggs were deposited under the shields of adult Coccids, and in cracks in the bark or under lichen and other shelters. The total number of eggs laid per female averaged 112 for *C. renipustulatus*, 132 for *C. bipustulatus* and 103 for *C. r. inornatus*. In July–September, 85–99·6 per cent. of the larvae, pupae and adults of the two indigenous Coccinellids were destroyed by parasites, of which *Tetrastichus coccinellae*, Kurdj., was the most important. *C. r. inornatus* was also liberated in Sochi and Slavyansk (northern Caucasus) and occurred there throughout the summer. It is likely to be of importance, as it appears in the field earlier than the two indigenous Coccinellids and is, therefore, able to attack the overwintered scales and to complete a generation before it is liable to attack by the parasites.

Ponomareva (L. M.). **Tests of *Trichogramma evanescens* W. for the Control of the Cotton Boll Worm (*Chloridea obsoleta* F.)**, pp. 54–55. Investigations in Azerbaijan are described in which *Trichogramma evanescens*, Westw., was released against *Heliothis armigera*, Hb. (*Chloridea obsoleta*, F.) on cotton on experimental plots 2½ acres in area on 26th or 29th September 1936, during a period of intense oviposition by the moth. The mean temperature varied from 16 to 21·5°C. [60·8–70·7°F.] and the relative humidity from 55 to 77 per cent. Examination of the plants about a week after the release of the parasite showed that in plots in which the adults had been liberated at the rate of 300,000 per plot on the two dates, respectively, 71·3 and 76·7 per cent. of the eggs of the moth were parasitised; and in plots in which 300,000 and 100,000 parasitised eggs had been exposed on cards, the percentages of parasitism were 60·4 and 83·6, and 67·8 and 73·1, respectively. Since the chief damage to cotton is caused by the third generation of *Heliothis* in July, the parasite should be released at the rate of 120,000 per acre when the second generation adults are present in the field.

Romanova (V. P.) & Il'inskaya (L.). **Methods for Large-scale Rearing of *Lariophagus distinguendus* Först. and its Hosts,** pp. 55–58. In laboratory experiments to determine the best method of rearing the Pteromalid, *Lariophagus distinguendus*, Först., the granary weevil, *Calandra granaria*, L., and the rice weevil, *C. oryzae*, L., were found to be suitable hosts. The best results were obtained at a temperature

of 30°C. [86°F.] and a humidity of the grain of 15–16 per cent., under which conditions the generations of the parasite succeeded one another at intervals of 21 days and those of the weevils in 40 days on an average. When the moisture content of the grain exceeded 18–20 per cent., the development of the weevils was retarded, and about 30 per cent. of the larvae died. The life-cycle of *C. granaria* was shorter on rye than on wheat, but the reverse was observed in the case of *C. oryzae*. The emergence of the young weevils was most intense at 27–30°C. [80·6–86°F.]. Females laid fewer eggs when reared on rye, the highest numbers observed being 96 for *C. granaria* and 178 for *C. oryzae*. When reared on wheat, adults of *C. granaria* survived for up to 193 days at 27°C. and 202 days at 30°C., the total number of eggs deposited being 255 and 292, respectively. *C. oryzae* lived up to 172 days at 30°C. and laid up to 260 eggs. Oviposition was very irregular, and 50–80 per cent. of the eggs were laid in the first two months after emergence.

The development of the parasite averaged about 16 days at 30°C. and about 23 at 25°C. [77°F.]. The emergence of adults from the grain lasted 6–7 days, the males appearing earlier than the females. Females were usually twice as numerous as males. The oviposition period lasted 10–13 days, and the number of eggs laid by a female averaged 36·1 at 30°C. and 37·5 at 25°C. About 50 per cent. of the females died within 6 days of emergence. The parasite was able to penetrate a considerable thickness of infested grain, and occurred at a depth of 1 ft. in 2–3 days, provided that the upper layers of grain were not infested.

Selivanova (S. N.). **The Rôle of Predators in the Multiplication of the Pea Aphis *Acyrthosiphon pisi* Kalt.,** pp. 58–60. In the Province of Voronezh, outbreaks of *Macrosiphum onobrychis*, Boy. (*Acyrthosiphon pisi*, Kalt.) are rare, since it is kept under control by meteorological factors and by predators. Observations on the latter were carried out on a farm in June and July 1936. The Aphids began to migrate from lucerne to flowering peas about 10th June, but their development was retarded by unfavourable weather, and their numbers did not increase much until the end of the month, the peak of abundance being reached in the first five days of July, when the flowering of the peas was practically over. As a result, the Aphids chiefly concentrated on late flowers, which, owing to the prevailing drought, were sterile, and the infestation did not appreciably reduce the yield of peas. Though the conditions of temperature and humidity were favourable for the Aphids in July, there was a sharp reduction in their numbers, which was solely due to the activity of predators, chiefly Coccinellid larvae. The latter, however, became abundant only in the second half of July, a fortnight after intense reproduction of the Aphid had begun, and would, therefore, be most effective during its second peak of abundance.

Sidorovnina (E. P.). **A Field Experiment with *Trichogramma* for the Control of the Codling Moth in Azerbaidzhan,** pp. 60–63. In view of the encouraging results obtained in Azerbaijan in 1935 in the control of *Cydia pomonella*, L., by means of *Trichogramma evanescens*, Westw. [**25** 152], further experiments, against the second generation, were carried out in the district of Kuba in 1936 in ten apple orchards covering a total area of several hundred acres. Cards

bearing parasitised eggs of *Sitotroga cerealella*, Ol.*, were fixed to the trees, or equivalent numbers of adult parasites were released, usually on two or three days during the period of oviposition of the moth. Examination of the fruits on selected trees every ten days showed that infestation of different varieties of apples was reduced (in comparison with controls) by 65·6–87·6 per cent. in plots in which 120 cards were used per acre, and by 73·5–94·5 per cent. in a plot in which 60 cards per acre were used. In another plot, in which infestation was slight and 60 cards were used per acre, only 23·1–33·2 per cent. of the eggs were parasitised, probably owing to the difficulty experienced by the parasite in finding them when they were scarce. The author considers, therefore, that more parasites should be liberated in lightly infested areas than in those in which the host is numerous. In the plot in which adults of *T. evanescens* were released at a rate equivalent to 120 cards per acre, the infestation was reduced by 77·3–93 per cent.

Pospelov (V. P.). **Methods of infecting Insects with entomogenous Fungi,** pp. 64–67. In laboratory experiments in Leningrad at 25°C. [77°F.] and 80–90 per cent. relative humidity, in which plants infested with larvae of *Loxostege sticticalis*, L., were sprayed with an aqueous suspension of a culture of the white muscardine fungus, *Beauveria bassiana*, recovered from diseased larvae of the moth taken in the field in the preceding autumn, or dusted with the spores, complete mortality of the larvae was obtained in 7 and 3–4 days, respectively. Adult moths died 2–6 days after feeding on unfermented beer containing 1 per cent. by volume of spores of *B. bassiana*. At 20–22°C. [68–71·6°F.] and a humidity of 54–85 per cent., the fungus killed 80–100 per cent. of the larvae of *Agrotis segetum*, Schiff., and of *Pieris brassicae*, L. When artificially infested cabbages were dusted in the field, 7 of 10 larvae were dead by the fourth day, and the others abandoned the plants. Spores of the green muscardine fungus, *Metarrhizium anisopliae*, isolated from diseased larvae of *Anisoplia austriaca*, Hbst., in the laboratory gave complete mortality of adults of *Cleonus punctiventris*, Germ., when dusted on infested beet in May, during the oviposition period, or in August, when the young weevils were emerging. Mortalities of 81·4 and 85·7 per cent. were obtained, respectively, by strewing the spores on larvae on the roots of the beet and by mixing the spores with the soil. The rate of infection was low in larvae in soil of which the pH was 6, but complete mortality was obtained when the pH was above or below this value. In the field, the rate of natural infection of the larvae of *Cleonus* with this fungus was higher in dry soil, which is unfavourable for the development of both beet and larvae. Examination of the dead larvae showed that *M. anisopliae* had seldom penetrated the integument from without; it had generally begun to develop in the fat-body and the epithelium of the tracheae, and after penetrating the body tissues, the mycelium and conidiophores appeared on the surface. It seems that the fungus was already present in an unrecognised form in the organs of the larvae, and the introduction of the spores or an unfavourable environment increased its virulence and induced the growth of the mycelium. Eggs of *Melolontha melolontha*, L., were observed by one worker to contain filaments of the mycelium, and though the resultant larvae were normal, this suggests that the fungus

* The author does not state the number of eggs per card but is known to have used 750 in 1935.—Ed.

may be present in an insect in the egg stage and may sometimes be transmitted to the larva.

Volkov (V. F.). **Testing the entomogenous Fungus** *Beauveria bassiana* **in the Control of** *Loxostege sticticalis*, pp. 67–69. Some mortality of larvae of *Loxostege sticticalis*, L., was obtained in the laboratory in Leningrad and in the south of the region of Kherson by infecting them with the fungus, *Beauveria bassiana*, five strains of which were isolated from larvae of this moth from western Siberia and two from larvae of *Agrotis segetum*, Schiff. In the Kherson region, under approximately natural conditions, one of the strains from *Loxostege* killed all the larvae. Dusting gave better results than spraying, and decreased humidity lowered the effectiveness of the fungus. When the adults of *Loxostege* were placed in glasses containing dry or moist sand and 5–50 per cent. solutions of honey in water infected with *B. bassiana*, 90 per cent. of the males and 60 per cent. of the females were infected and died. Infected females did not oviposit. In the field, spraying with *B. bassiana* from 6th June to 10th July against third-instar larvae of *L. sticticalis* on *Sorghum*, at a mean day temperature of 22·7–24°C. [72·86–75·2°F.] and a humidity of 50–71 per cent., gave negative results, irrespective of the rate of application, probably owing to the weakness of the strains and to high temperatures and low humidity.

Zaĭtzeva (A. Ya.). **Application of Metalnikov's Bacilli in Controlling Cabbage Pests and Maize Smut,** pp. 69–73. Complete mortality of the larvae of *Pieris brassicae*, L., *P. rapae*, L., and *Plutella maculipennis*, Curt., was given in 1935 in laboratory and field experiments by the use of a mixture of three strains of bacilli obtained from Metalnikov [*cf.* **25** 795]. In experiments in 1936, the three strains of the bacilli were used to prepare a powder that was applied dry or suspended in water. The cultures were grown on alkali potato agar, which in 10 days became covered with spores; the latter were then washed off with water, potato flour was added to ensure the more rapid evaporation of the water and prevent the spores from decomposing, and the dry substance thus obtained was pulverised in a mortar. Preliminary laboratory tests on several species of Lepidopterous larvae, the results of which are tabulated, showed that the spores did not lose their virulence when preserved in the form of powder. In the field, 5 lb. powder in 2 gals. water gave 69–100 per cent. mortality, and dusting 26–93 per cent., of various caterpillars on cabbage. There was no mortality in larvae on control plants. The effectiveness of the bacilli depended directly on temperature; thus, 88 per cent. of the larvae of *P. brassicae* were killed at 24°C. [75·2°F.], as compared with only 26 per cent. at 14°C. [57·2°F.].

Pilat (M. V.). **Permeability of the Chitin of Insects to entomogenous Fungi,** pp. 73–75. In field and laboratory investigations on the penetration of entomophagous fungi into insects, larvae of *Loxostege sticticalis*, L., *Pieris brassicae*, L., *Agrotis segetum*, Schiff., *Melolontha melolontha*, L., *Anisoplia austriaca*, Hbst., and *Cleonus punctiventris*, Germ., were infected with spores of *Beauveria bassiana*, *Spicaria fumosorosea* and *Metarrhizium anisopliae*. It was shown by dissection of infected larvae that the fungi are able to penetrate the chitinous integument from both the outside and the inside. The changes that take place in the chitin of infected larvae are described.

Evlakhova (A. A.). **Experiments on the Control of** *Ceroplastes sinensis* **Del Guer. with the Fungus** *Cephalosporium lecanii* **Zimm.,** pp. 75–77. As a result of the wet spring of 1936, several species of Coccids, which are enumerated, became infected with *Cephalosporium lecanii* in the region of Batum. Several strains of this fungus isolated from mummified Coccids were tested in May–July in the district of Sukhum on *Ceroplastes sinensis,* Del G., which was abundant on mandarin oranges.

Small pieces of potato bearing spores of *C. lecanii* were dried and pulverised, and applied to infested branches either as a powder or as a 10 per cent. suspension in water. The percentage mortalities of the Coccids given by spraying and dusting were 27·7–100 and 13–19·4, respectively, some of the strains proving more virulent than others. Combined spraying and dusting gave 13·4–46·6 per cent. mortality. Dead Coccids became covered with mycelium, and a pure culture of *Cephalosporium* was isolated from them. The hyphae of the fungus penetrated the thick chitinous and waxy layers from within.

Dashkevich (B. N.) & Dmitriev (A. K.). **Adsorptive Sulphur Preparations,** pp. 78–81. An account is given of experiments made in view of the fact that dusts of sulphur adsorbed on a carrier proved to have high toxicity to Tetranychid mites. It was found that the sulphur from such dusts evaporated very slowly. The carrier proved to be of no importance in the toxic action, and it is therefore best to select one that is fine and disperses well, and with which the dust is easily prepared. Subsidiary tests showed that evaporation of sulphur occurs in the absence of oxygen or moisture, but that moisture greatly accelerates it, and also that different forms of sulphur differ in toxicity to mites, amorphous sulphur being one of the least toxic. For the latter reason, natural sulphur is more effective than sublimated sulphur, as the former chiefly consists of rhombic sulphur, whereas 40 per cent. of the latter is amorphous sulphur.

Sazonov (P. V.). **Improvement of Ultra-Sulphur Preparations,** pp. 81–83. Previous investigations have shown that ultra-sulphur [a very fine dust consisting of sulphur adsorbed on a carrier] is more toxic than the ordinary ground sulphur, but that it is inferior in practice, as it does not adhere well to the surface of the leaves and is easily carried away by the wind. Since, however, it has been found that the effectiveness of dust insecticides can be increased by the addition of mineral oils [*cf.* **25** 130, 157], field experiments were carried out in Uzbekistan in which dusts of ultra-sulphur (containing 15 per cent. sulphur) alone or with the addition of 7, 9 or 11 per cent. of spindle oil were applied to plants infested with a red spider [*Tetranychus*] at the rate of 45–54 lb. per acre. The addition of the oil increased the effectiveness of the dusts, the best results being obtained when 9 per cent. was added. In the plot dusted with ultra-sulphur alone, the number of mites per leaf on the day before application and 3, 8 and 12 days after it averaged 3·82, 3·58, 2·17 and 2·85, respectively, as compared with 3·46, 1·72, 1·31 and 0·87 in the plot to which sulphur containing 9 per cent. oil was applied. In the untreated controls, these numbers were 3·12, 3·38, 3·08 and 3·77.

Skryabina (E. A.). **Comparative Resistance of Insects to HCN,** pp. 83–86. Experiments to determine the toxicity to various insects

of hydrocyanic acid gas at a concentration of 5 mg. per litre and with exposures ranging from 30 seconds to 6 hours showed that the minimum exposures in hours that caused complete mortality within 24 hours were 1 for *Agelastica alni*, L., *Chrysomela fastuosa*, Scop., and fifth-instar hoppers of *Locusta migratoria*, L. ; 3 for second-instar larvae of *Melolontha* sp., and 6 for fifth-instar larvae of *Agrotis* (*Euxoa*) *segetum*, Schiff. The percentage mortalities of *Calandra granaria*, L., and fifth-instar larvae of *Pieris brassicae*, L., given by 6 hours' exposure were 14 and 58, respectively. When the concentration was doubled, these figures rose to 47 and 100. The coefficients of resistance, calculated by the method of Bliss and corresponding to a probit of 50 per cent. mortality [**24** 171], were 0·78 for *Agelastica*, 1·24 for *Chrysomela*, 1·49 for *Melolontha*, 1·61 for *Locusta*, 1·72 for *Agrotis*, 2·38 for *Pieris* and 3·65 for *Calandra*. The minimum periods within which paralysis occurred in all the individuals subjected to fumigation (stupefaction time [**24** 171]) were 15 seconds for *Agelastica* and *Melolontha*, 30 seconds for *Chrysomela* and *Agrotis*, 1 minute for *Calandra*, and 2 minutes for *Locusta* and *Pieris*. The durations of paralysis, estimated as the interval from the cessation of fumigation to complete recovery from stupefaction, were 10 hours for *Locusta*, 12 for *Agrotis* and *Pieris*, and 3 days for *Calandra*, *Melolontha* and *Chrysomela*. This indicates that the susceptibility of insects to paralysis caused by HCN differs from their susceptibility to its lethal action, and that protracted paralysis is not a characteristic of the resistant species only.

Toshevikova (A. G.). **The Effect on Plants of fluorine and fluosilicate Insecticides,** pp. 86–88. Experiments, in which apple, apricot and peach were used, showed that solutions of fluorides or fluosilicates penetrated into the branches as rapidly as sodium arsenate, provided that they were injected into the petioles or the leaves were immersed in them. When, however, leaves were merely wetted with fluosilicate solutions, the rate of penetration was considerably less than that of sodium arsenate, and the only leaves that became scorched were those that had actually been wetted. When small pieces of fabric soaked in fluosilicate solutions were applied to some of the leaves, symptoms of scorching appeared also on the adjoining leaves, but the injury was much slighter than that caused by sodium arsenate. Special observations, the results of which are tabulated, showed that, when introduced through the membrane of the protoplasm, sodium and barium fluosilicates caused visible injury more rapidly than sodium arsenate. When the insecticides were introduced through the epidermis of the leaves, the reverse occurred. The restricted distribution of injuries due to fluosilicates in plants is probably due to their slow penetration through the epidermis of the leaves and their high toxicity, which cause certain parts of the leaves to die, and thus prevent the poison from spreading further. Under favourable conditions, however (as in the experiments on the application of small soaked pieces of fabric), fluosilicates penetrate into the vascular system and spread in the plant, causing general poisoning.

Bobkov (S. D.). **A Measurement of the Electric Charge of Dust Insecticides and its Effect upon the Efficiency of Preparations,** pp. 88–91. The relative adhesiveness of sodium fluosilicate dusts mixed with viscous organic substances or various mineral carriers was found to

vary directly with the electrical charge of the dust. Viscosity and electrical conductivity are in inverse proportion, and in most cases the adhesiveness of the sodium fluosilicate dust was increased by the addition of the organic substances and reduced by the mineral carriers. No relation was observed between the adhesiveness and the electrical charge in sodium fluosilicate mixed with soaps, or between the electrical charge and toxicity. Tests with sodium fluosilicate alone or mixed with tar, colophony or clay showed that, with the exception of the clay mixture, the spread of the dust cloud was inversely proportional to its electrical charge, a greater amount settling near the dusting apparatus as the charge increased. Preparations that were most apt to form lumps after having been kept for several months were found to have the lowest electrical charge.

Blyumberg (G. V.). **Technical Effectiveness of Pyrethrum Extracts prepared by Means of hot Extraction,** pp. 91–93. In the Russian Union, dusts or sprays of pyrethrum have given very contradictory results as insecticides, which is due to the fact that pyrethrum is seldom used in the year in which the flowers are harvested. During storage, the flowers lose 30–43·6 per cent. of their toxicity in a year, owing to reduction in pyrethrin content. Pyrethrum extracts do not lose their effectiveness during storage, but when prepared by the cold method of Gnadinger and Corl, 0·03–0·05 per cent. pyrethrins remain in the flowers. In tests of extraction by a hot method [which is not described], it was shown that pyrethrins are sufficiently thermostable, and 100 per cent. extraction of pyrethrin I from the flowers was secured in 6–8 hours. In field experiments on spraying with the extracts in various dilutions in water, with or without the addition of soap, against the spiders [*Tetranychus*] on cucumbers and larvae of *Pieris brassicae*, L., on cabbage, the best results were obtained with the extract containing 3 per cent. pyrethrin I, which, used at dilutions of 0·05 and 0·07 per cent. in 1·5 per cent. soap solution, killed 93 per cent. of the larvae of *P. brassicae* and 99 per cent. of the mite, respectively.

Voskresenskaya (A. K.). **Can Pyrethrum be used as a Stomach Insecticide ?** pp. 93–95. Fifth-instar larvae of *Agrotis* (*Euxoa*) *segetum*, Schiff., *Pieris brassicae*, L., *Lymantria* (*Porthetria*) *dispar*, L., and *Locusta migratoria*, L., were fed on leaves dusted with pyrethrum containing 1·43 per cent. pyrethrin I, or a mixture of kieselguhr and pyrethrum containing 1 per cent. pyrethrin I. From 5 to 10 minutes after ceasing to feed, the insects regurgitated, and 3–7 minutes later began to show spasmodic contractions of the body, which lasted for 4–5 hours. The insects then remained motionless and did not react to mechanical irritation, but on the following day they recovered and resumed feeding. In experiments by B. A. Dodonov, occasional instances of mortality were given by very high dosages of pyrethrum dust far exceeding the lethal dosages of mineral stomach poisons. The injection into the body cavity of the insects of two drops of a solution containing pyrethrum at the rate of 0·0005 mg. pyrethrin I caused frequent and violent contradictions of the fore and hind sphincters and of the fore gut, which resulted in a rapid voiding of the digestive tract through regurgitation and evacuation of excreta [*cf.* **25** 155]. The author concludes, therefore, that pyrethrum is not an effective stomach poison.

[Rubtzov (I. A.).] **Рубцов (И. А.). A morphological Description of the Spring Crops Fly** (*Phorbia tritici* **sp. n.**). [*In Russian.*]—*Sborn. Trud. Zashch. Rast. Vost. Sibiri* no. 5 pp. 5–16, 15 figs., 2 refs. Irkutsk, 1937. [Recd. 1939.]

The Anthomyiid pest of cereals known as the spring crops fly in the Russian Union has constantly been recorded as *Hylemyia* (*Phorbia, Adia*) *genitalis*, Schnabl, in the Russian literature since it was identified as this species by Kurdyumov [*R.A.E.*, A **2** 350]. The author questions the correctness of this identification, and gives detailed descriptions of all stages of an Anthomyiid attacking wheat in East Siberia, which he names *H.* (*P.*) *tritici*, sp. n. It was previously recorded by him as *genitalis* [**24** 356], and, from a preliminary examination of collections, he considers that it may be the species injurious to cereals in other parts of the Union.

[Goncharova (A. A.).] **Гончарова (А. А.).** *Phorbia* **sp. in the Conditions of East Siberia.** [*In Russian.*]—*Sborn. Trud. Zashch. Rast. Vost. Sibiri* no. 5 pp. 17–49, 4 diagr., 6 refs. Irkutsk, 1937. (With a Summary in English.) [Recd. 1939.]

Studies of the biology and economic importance of *Hylemyia* (*Phorbia*) [*tritici*, Rubtz. (*genitalis*, auct.)] were continued in the region of Irkutsk in 1935 and 1936 [*cf. R.A.E.*, A **24** 356]. All stages are described. There was only one generation a year, the pupal stage lasting from the second half of July to the end of the following May. The adults began to emerge when the temperature sum in the spring reached 250–260 day-degrees C., provided that humidity was normal. In the insectary, they emerged 3 or 4 days earlier in cages that were moistened daily than in those that were kept more or less dry. The mass flight usually coincided with the flowering of *Prunus padus*, *Taraxacum officinale* and *Pulmonaria mollissima*, and lasted about five weeks. The females emerged with undeveloped ovaries and required supplementary feeding. Under experimental conditions, the flies that lived long (for up to 21 days) and the only ones that oviposited readily were those fed on sugar solution or confined with flowering *P. mollissima*. The maximum number of eggs laid by one female was only ten. The young flies remain for some time at the place of emergence, where they feed and pair, but if no plants suitable for oviposition are available, they then migrate to neighbouring fields of spring-sown wheat or rye ; in one instance they flew to rye from a field of potatoes over 500 yards away. Infestation was most intense near the edges of the fields. Mass oviposition took place between 8th and 14th June, and the oviposition period lasted about 25 days. The females selected healthy well-developed plants and usually laid only one egg on each, but if the flies were abundant, up to 5 eggs were sometimes deposited on the same plant by different individuals. About 81 per cent. of the eggs hatched. The larvae appeared in the field in mid-June, and the larval stage lasted about 3 weeks. The young larva descends to the base of the main stem and penetrates into the tillering node, where it remains all its life. Special experiments indicated that when several larvae are present in a stem, one destroys the others. Pupation took place in mid-July, usually in the soil at a depth of 2 ins. or less but sometimes in the base of the stem. About 3 per cent. of the pupae were parasitised by Ichneumonids.

Though infestation was most severe in spring-sown wheat and rye, it also occurred in winter wheat and rye, but was very slight in barley. In the case of wheat, the flies preferred soft varieties [*cf.* **12** 141], especially those in which the first leaf and sheath are hairy. Grasses, with the exception of young shoots of *Bromus* sp. and *Agropyrum repens*, were only slightly attacked; their leaves and stems are coarse by the time that the flies oviposit and the leaf-sheath adheres well. Crops sown in mid-May were more infested than those sown about a fortnight later, probably because the latter sprouted after the peak of oviposition was over. Contrary to previous observations [**24** 356] sparsely sown wheat was invariably more severely infested, probably because the flies select vigorous plants, of which there are fewer in densely sown fields. Growing wheat or rye in the same fields for several consecutive years resulted in increased infestation.

The effect of infestation on the plant is discussed at length. It is killed if the larva penetrates the tillering node before several secondary stems appear; otherwise, it survives and tillers, but the yield of the grain and straw is reduced. In spring-sown crops it is the main stem that is usually damaged, but in autumn-sown crops the secondary shoots are more infested, as the main stems are usually too coarse. The coefficient of injury caused by the fly [**14** 285] was found to vary from 28 to 76 per cent. for different varieties of wheat. The control measures recommended are crop rotation, cultivation of resistant varieties of wheat, and autumn ploughing to a depth of about 7 ins., which kills nearly half the pupae. The latter are very resistant to exposure in the spring, and ploughing then does not increase mortality from natural causes during hibernation, which is about 20 per cent.

[Rodd (V. E.)] **Родд (B. E.). On the Survival of the Corn Mites (Tyroglyphidae) in the Ground in East Siberia.** [*In Russian.*]—*Sborn. Trud. Zashch. Rast. Vost. Sibiri* no. 5 pp. 50–61, 1 ref. Irkutsk, 1937. (With a Summary in English.) [Recd. 1939.]

Observations to ascertain whether grain mites can survive in the soil in East Siberia as they do in northern Caucasus [*R.A.E.*, A **24** 580] were carried out in 1936 in a locality in the forest-steppe zone where the winters are very cold, with temperatures as low as —45°C. [—49°F.], and the summers are hot and dry. Examination of 704 samples of infested grain from different localities showed that *Tyrophagus putrescentiae*, Schr., is rare in East Siberia, whereas *Tyroglyphus farinae*, DeG., and especially *Lepidoglyphus* (*Glycyphagus*) *destructor*, Schr., are common and widely distributed. In the investigations described, wheat and oats, naturally or artificially infested with all stages of these mites, were planted in small plots in May and June, and the seeds, roots, green parts of the plants and the soil were periodically examined. It was found that the mites began to leave the seeds after 2 days; only isolated individuals were found in samples taken after 12 days and none in those taken after about 2½ months. The mites lived on seeds that did not germinate; those that sprouted normally were seldom attacked. No mites were found in the soil at some distance from the seeds. Grain in the ears is apparently also not attacked by the mites, as in experiments in which ears of wheat were artificially infested with *T. farinae*, only one individual was present 25 days later. Repeated examination of samples of grain from sheaves and stacks that had been kept in the field for a month or more showed

that they were free from mites. When infested and uninfested seeds of wheat and oats were sown in separate plots, there was no difference in the rate of sprouting, the intensity of tillering and development of the resulting plants, or in the ultimate yield of grain. It is concluded, therefore, that in East Siberia seeds that have normal germinative power (as shown by preliminary tests) can be sown irrespective of whether or not they are infested with mites.

[Kuznetzova (L. A.).] **Кузнецова (Л. А.). The possible Use of Skorodite Ore and porous Slag (a Waste of local chemical Industry) as Insectofungicides.** [*In Russian.*]—*Sborn. Trud. Zashch. Rast. Vost. Sibiri* no. 5 pp. 157–163, 1 ref. Irkutsk, 1937. [Recd. 1939.]

Experiments were carried out in the summer of 1936 near Irkutsk to ascertain the value as insecticides of ground scorodite ore and porous slag (a local waste product). The ore contained 21·08 per cent. arsenic pentoxide, and the slag contained 11·57 per cent. arsenic pentoxide and 3·99 per cent. arsenic trioxide, of which only 1·3 per cent. was soluble in water. In the laboratory, finely ground ore and slag (sifted through a sieve with meshes 0·1 mm. wide) killed 52 and 92 per cent., respectively, of the larvae of the rape sawfly [*Athalia rosae*, L.]. In field experiments, in which each was applied to rape at the rate of 9–13½ lb. per acre, the finely ground slag gave 90·27 per cent. mortality of the larvae in 48 hours when used alone, and 91·74 per cent. when mixed with 10 per cent. talc, but the ore was ineffective. In experiments against larvae of *Loxostege sticticalis*, L., on carrots, however, coarsely ground ore at the rate of 9 lb. per acre killed 57–61 per cent. in 5 days, while coarsely ground slag killed 54–56 per cent. when used alone, 59–62 per cent. when mixed with 10 per cent. talc, and 60·5–65 per cent. when mixed with 50 per cent. chalk. In all experiments, scorching was slight.

[Luk'yanovich (F. K.).] **Лукьянович (Ф. К.). The theoretical Basis of the Distribution of harmful Insects and of Predictions as to their Mass Multiplication. III. The Significance of the Problem of the nutritional Relationships of herbivorous Insects.** [*In Russian.*]—*Plant Prot.* no. 17 pp. 15–24, 25 refs. Leningrad, 1938. (With a Summary in English.)

[Rubtzov (I. A.).] **Рубцов (И. А.). IV. The Effect of constant and variable Temperatures on the Development of the Eggs of the Gipsy Moth (*Porthetria dispar* L.).** [*In Russian.*]—*T.c.* pp. 25–38, 4 graphs, 17 refs. (With a Summary in English.)

[Vasser (R. É.).] **Вассер (Р. Э.). V. L'influence de la température et de l'humidité de l'air sur le développement du Tetranyche du coton.** [*In Russian.*]—*T.c.* pp. 39–51, 3 graphs, 8 refs. (With a Summary in French.)

The first paper is a general discussion of the importance of questions of the relationship between insects and plants both from the point of view of the protection of crops, etc., from pests, and from that of the study of problems of classification, comparative morphology, distribution and ecology. The adaptation to cultivated plants of

insects that usually live on wild vegetation is of particular practical interest. The determination of the complex of causes that are responsible for the preference constantly shown by certain species of insects for certain plants is of great importance ; field and laboratory experiments with substances that attract insects and have been extracted from plants would form a scientific basis for the elaboration of the method of controlling pests with baits. Investigations on the geographical distribution of insects and their food-plants would facilitate the determination of potential pests in regions into which it is proposed to introduce new crops. The main points that should be included in the study of insect phytoecology are outlined.

In the second paper, an account is given of laboratory observations from January to the end of June 1937 on the effect of constant and varying temperatures on the duration of development of the eggs of *Lymantria* (*Porthetria*) *dispar*, L. The eggs were collected in the preceding autumn and kept at a temperature of about 0°C. [32°F.] and a relative humidity of 95–98 per cent. until required. From a survey of the literature on work with various insects and his own observations, the author concludes that there is no constancy in the threshold of development, whether empirical or theoretical ; it is difficult to determine exactly, and it varies greatly in phases of an insect that are able to diapause. In the eggs of *L. dispar*, the threshold of development fell slowly from about 10°C. [50°F.] in January to 6·3°C. [43·34°F.] in May and 5·5°C. [41·9°F.] in June. Eggs laid in the laboratory in April at 20–24°C. [68–75·2°F.] and a humidity of 80 per cent. diapaused and did not develop at any temperature. Observations showed that the variation in rate of development of the eggs at different constant temperatures was more accurately and completely represented by Janisch's catenary curve [*cf. R.A.E.*, A **21** 378, etc.] than by the hyperbola of Blunck [*cf.* **23** 296]. The thermal constant (sum of effective temperatures) varied regularly, rising in the zones of depression and falling to the minimum at the optimum. At variable temperatures, however, though having the same absolute mean value as at constant temperatures, it was of a more stable character and more in conformity with the Blunck formula, as the rise in the zone of depression was less pronounced. The author concludes, therefore, that Blunck's formula, based on data obtained at constant temperatures, is applicable in practice, in view of the variable temperature conditions in nature. Though the curve of development does not completely correspond to the hyperbolic relation, the deviations are of a definite and regular character.

In the third paper, details are given of the results of laboratory observations on the effect of temperature and humidity on the development of a red spider (*Tetranychus*) collected on cotton in Armenia and reared on beans. Data on the influence of these factors on cotton red spiders in the Russian Union, which are reviewed, are contradictory, especially with regard to humidity. They are, however, all based on field observations, carried out in different areas and apparently on different races or species of the mite. The author's experiments, which were carried out at temperatures of from 21 to 36°C. [69·8–96·8°F.] and relative humidities of 20–100 per cent., showed that the mite can adapt itself to a wide range of both factors, its rate of development being chiefly affected by temperature. High humidity (above 80 per cent.) is, however, detrimental to it, especially if combined with a temperature above 30°C. [86°F.]. Mortality

is lowest and egg production greatest at about this temperature and a relative humidity of 35–55 per cent., while development is completed in almost as short a time (7–9 days) as at a higher temperature.

[Beĭ-Bienko (G. Ya.).] **Бей-Биенко (Г. Я.). On the Rôle of Harvesting Machinery in the Control of Insect Pests.** [*In Russian.*]—*Plant Prot.* no. 17 pp. 53–60, 5 refs. Leningrad, 1938. (With a Summary in English.)

Observations made in the Province of Orenburg during the harvesting of wheat with a reaping machine in August 1936 showed that many insects fall into the box attached under the platform of the binder to catch grain that drops from the ears. Over 4,000 Arthropods, of which a large percentage consisted of insect pests of wheat, were thus collected from an area of 1,000 sq. ft. Details of the species and numbers taken are given in a table. It is recommended to empty the grain catcher several times during the day and destroy the insects found in it.

When a machine that threshes the wheat as it is reaped was used, dead Arthropods to a number estimated at about 6,400 per acre were found in the grain bin. Actually, however, the number destroyed in the process of threshing must be far greater, as four times as many dead Arthropods were found in a sample of grain from the spiral conveyer in the winnowing part of the machine as in one from the grain bin. This indicates that most of them are fanned out during the winnowing of the grain. Over a third of the Arthropods in the spiral conveyer were Orthoptera, and about a third were larvae of *Trachea basilinea*, F. The numbers of insects caught in harvesting machines will increase if harvesting is early, as other observations have shown that the insect population of wheat fields is much higher during the period of the waxy ripeness of the wheat than later.

[Popova (A. I.).] **Попова (А. И.). The San José Scale.** [*In Russian.*]—*Plant Prot.* no. 17 pp. 61–77, 9 figs., 3 graphs, 1 map, 15 refs. Leningrad, 1938. (With a Summary in English.)

In the Russian Union, *Aspidiotus perniciosus*, Comst., has been observed in the Caucasus since 1931 [*cf. R.A.E.*, A **26** 305–307, etc.] and was found to occur in south-western Turkmenistan and in the Russian Far East in 1935. Its local distribution in the Caucasus is discussed, and an account is given of its bionomics as observed there in 1933–36 in three widely separated districts (Maĭkop and Slavyansk in the Krasnodar region and Sochi on the Black Sea Coast), in all of which it was very abundant, though they differ greatly in climate. Hibernation occurs as a first-instar larva, but in the district of Sochi isolated females continue to produce larvae in winter and survive temperatures as low as —7·3°C. [18·86°F.]. Usually there are three generations a year in Sochi, but sometimes a partial fourth is produced. In the Maĭkop and Slavyansk districts, there are two complete generations and a partial third. The life-cycle is completed in 60–61 days. Of these, the development from crawler to adult occupies 30–31 days. The males live for only a few hours, but the females require 28–31 days for the maturation of the eggs in their ovaries and produce larvae for a further 40–60 days.

In the Russian Union, *A. perniciosus* attacks a great number of plants, a list of which is given; apple, pear, plum and peach are the most frequently infested. The character of the injury caused is discussed at length [*cf.* **26** 305, 306]. Infestation is most severe in the damp parts of orchards, where the subsoil water is relatively near the surface. This is probably due to the increased evaporation, which is favourable for the development of the scale, and to the fact that crawlers that fall from the trees are better able to survive on a damp soil than on a dry one; in the former case they can resist starvation up to 7 days, whereas under dry conditions they succumb in 4 [but *cf.* **26** 306]. Males predominated in all generations, and particularly towards the end of the season, on trees on which infestation became more severe. The percentage of females on fruits of apple and pear, however, increased as they ripened.

Infestation is reduced by frosts in winter and sharp fluctuations of temperature in the spring. In 1934, mortalities of up to 80 and 86·8 per cent. were caused by frosts of —30°C. [—22°F.] and —32°C. [—25·6°F.] in the districts of Maĭkop and Slavyansk, respectively. In the summer, there is a mortality of 11–35 per cent., chiefly among the first-instar larvae. In the district of Sochi, sharp day and night fluctuations of the temperature in spring usually cause a mortality of about 40 per cent. Rain and wind kill 30–40 per cent. of the young larvae. From 20 to 44·4 per cent. of the scales are destroyed by the Coccinellids, *Chilocorus renipustulatus*, Scriba, and *C. bipustulatus*, L., which become abundant rather late, at the end of May or beginning of June, when the larvae of the first generation have already appeared. At the end of June, some of these larvae enter a diapause (the cause of which has not been ascertained), the percentage of individuals that do so varying from 9·3 to 35 in different years.

[Nikitina (T. F.).] **Никитина (Т. Ф.). The Biology and Ecology of *Hylemyia brassicae* Bouché in Gorki Province.** [*In Russian.*]—*Plant Prot.* no. 17 pp. 79–85, 2 graphs, 1 diagr., 6 refs. Leningrad, 1938.

The results are given of observations extending over eight years (1929–36) on *Hylemyia brassicae*, Bch., infesting cabbage in the environs of the town of Gor'kiĭ on the Volga. *H. floralis*, Fall., was also observed in 1936, when it was abundant in September and October on cabbages grown on sandy and sandy-clay soil. *H. brassicae* had two generations a year, but the damage was chiefly caused by the first generation. Oviposition by adults from overwintered pupae began in May, when cherries began to flower and the mean day temperature fluctuated between 10·7 and 17·7°C. [51·26–63·86°F.]. It continued for 40–45 days, the greatest number of eggs being laid in the second half of June. The first larvae appeared when lilac began to blossom. The eggs of the first generation hatched in 7–10 days in the laboratory, and the larval and pupal stageas lasted 20–26 and 11–20 days, respectively, in the field. Some of the pupae of the first generation remained in diapause until the following spring. The average and maximum numbers of eggs laid on a plant by adults of the overwintered generation were 51–52 and 136 on white cabbage, and 10 and 39 on red cabbage. First-generation adults laid considerably fewer eggs on cabbage, and deposited them chiefly on late varieties.

Observations on early cabbage grown in different types of soil showed that the number of eggs laid on the plants was greatest on well manured soil and greater on well cultivated light clay than on more sandy soil. The percentage of plants killed by the larvae was, however, greatest in the more sandy soil. In plots with the same type of soil, more eggs were deposited and more plants were killed on low-lying ground. Early varieties of cabbage and plants grown for seed were the most infested; of the former, preference was shown in descending order for cauliflower, white cabbage and red cabbage. Seedlings in frames were practically free from infestation.

In field experiments on control, some plants were treated by scattering 0·5 gm. paradichlorobenzene round the base of each and others by watering with a solution of mercury bichloride (1 : 1,200). The percentages of plants killed by the larvae were 36 in untreated plots, 10 in those treated with mercury bichloride on 2nd and 14th June, 14 on those treated with paradichlorobenzene on 2nd June and mercury bichloride on 13th June, and 20 on those treated with paradichlorobenzene on 2nd and 11th June. From these results and other observations, it is considered that at least four applications of mercury bichloride would be required for adequate control in view of the length of the oviposition period of the flies.

[Grigor'eva (T. G.).] **Григорьева (Т. Г.). On the Methods of Estimating Soil Fauna.** [*In Russian.*]—*Plant Prot.* no. 17 pp. 97–110, 5 figs., 25 refs. Leningrad, 1938. (With a Summary in English.)

Various methods of separating insects and other animals from samples of soil are reviewed [*cf. R.A.E.*, A **17** 183; **19** 213; **21** 481; **25** 109], and a description is given of an apparatus for washing soil samples that is a simplification of that designed by Morris [**10** 527] and was successfully used in investigations in the Province of Orenburg in 1936. It consists of four pails with the bottoms replaced by detachable wire screens with meshes of increasing fineness (3, 1·5, 1 and 0·2 mm.). The pails are placed one into another, and fit conveniently because the first and third are cylindrical and the other two wider at the top than at the bottom. The sample of soil is stirred up in water and rapidly poured into the top pail. The deposited soil is then washed once more with a fresh supply of water. Larger insects and other organisms, which are retained in the three upper sieves, are collected with fine forceps, and the residue on the lowest is washed once more through a fine mill gauze and examined in dishes through a low-power binocular.

In tests in the field, the results of which are tabulated, the numbers of animals obtained in this way from samples of various kinds of soil were 120–250 times as great, and the numbers of insects alone 4–36 times as great, as those obtained when the soil was examined by breaking it up through the fingers. Insects represented 59·3–96·7 per cent. of the animals obtained by the latter method and only 5·6 per cent. on an average of those obtained by washing, of which 48–95 per cent. were Nematodes and Enchytraeids. The chief reason for the larger numbers of insects obtained by washing was that it extracted Collembola and small Coleoptera and Diptera, which were overlooked when the soil was searched by hand.

The value of the different methods evolved since 1907 of separating animals from the soil is compared in a table showing the numbers (in absolute figures and percentages) of insects and other invertebrates obtained per sq. metre of soil by different workers, the year and place of the work and the types of plot from which the soil was taken. The best results were obtained by flotation in a solution of magnesium sulphate [**25** 109] and by the author's method. The latter gives the most complete representation of the numbers and ratios of the organisms occurring in the soil. The total numbers of invertebrates separated from the soil were much in excess of those recorded by other workers, being 60,855 individuals per sq. metre in virgin soil, 198,510 in old fallow and 73,375 in a wheat field.

[Chernuishev (P. K.).] **Чернышев (П. К.). On the Necessity of Modifying the Method of Estimating the Infestation of agricultural Products with Mites.** [*In Russian.*]—*Plant Prot.* no. 17 pp. 112–115, 2 figs., 4 refs. Leningrad, 1938.

The author has designed an apparatus for determining the degree of infestation by mites of samples of grain, etc., based on their negative phototropism and their tendency to escape from an environment that is being rapidly heated and dried. The apparatus is illuminated and heated from above by an electric bulb, and the infested material is placed on a screen over the wide end of a black funnel. The mites make their way through the screen and fall through the funnel into a receptacle containing alcohol or a solution of formalin. In tests with seeds of various crops, all the mites were induced to leave in 1–1½ hours at 60°C. [140°F.], and in another series of tests, mites were obtained from samples of grain in which none was detected by the ordinary method of shaking the samples on sieves.

[Novienko (A. I.), Treml', Kuznetzov & Buikhovtzeva.] **Новиенко (А. И.), Тремль, Кузнецов и Быховцева. The Distribution of Granary Mites in the Field and in Granaries and Methods for their Control.** [*In Russian.*]—*Plant Prot.* no. 17 pp. 115–119. Leningrad, 1938.

To determine whether grain becomes infested with mites in the field, examinations were made in three widely separated districts in the Ukraine of samples of plants of rye, wheat, oats and barley taken during the periods of the formation of shoots and ears and during harvest. With the exception of single individuals in shocks of straw, into which they were probably introduced during threshing, no granary mites were found.

Of granaries inspected in various districts in the Province of Kharkov, 89 per cent. were infested with mites. Vetch, oats, barley and wheat were the most infested crops.

The mites in loose heaps of wheat were found to concentrate and breed most rapidly where the temperature and humidity of the grain were highest, usually in the middle layers. The temperature in these layers decreased very gradually from 14·7 to 11·7°C. [58·46–53·06°F.], while the mean air temperature in the granary dropped from 9·4 to 0·6°C. [48·92–33·08°F.] ; this showed that airing the granaries is not

sufficient to cool the grain, which should be periodically turned over with spades or passed through a winnowing machine. In the case of grain with a humidity of 12·4–12·6 per cent. and a temperature of 20–21·5°C. [68–70·7°F.] in deep shafts in elevators, the mites very seldom increased in numbers. In laboratory experiments at 16–19°C. [60·8–66·2°F.], they did not increase at a humidity of 12·5 per cent.; maximum increase occurred at 14–17 per cent. humidity.

In experiments with mechanical means of control, the highest mortality (81·5–100 per cent.) was obtained when the infested grain was passed through a threshing machine. This should not, however, be done if the grain is to be stored for long, as 0·5–7 per cent. of it is broken in the process. Passing the grain through a separator and turning it over with spades killed 60·5–77·8 and 42–85·6 per cent. of the mites, respectively; winnowing killed only 12 per cent. Mechanical treatment of the grain should be carried out in dry weather, as otherwise its moisture content is increased. All the mites were killed when the grain was dried at a temperature of 80–120°C. [176–280°F.].

Fumigation with benzol at the rate of 3 oz. to 10 cu. ft. in chambers installed in the granaries killed 100, 99·4, 94·7 and 85·1 per cent. of the mites on the surface of heaps of grain and at depths of 20, 40 and 60 ins., respectively. The corresponding percentage mortalities were 100, 89·3, 75·4 and 59·6 for carbon bisulphide, used at the rate of 1½ oz. to 10 cu. ft., and 100, 100, 96·7 and 84·4 for chloropicrin, used at the rate of 0·6 oz. The periods of exposure were 72 hours for the first two fumigants and 48 hours for chloropicrin.

Chloropicrin reduced the germination of the grain considerably, but benzol and carbon bisulphide did not affect it. The results of analyses of bread made of flour from grain fumigated with benzol were contradictory. Animals were not affected when fed on grain that had been fumigated with chloropicrin and then aired for 24 hours and turned over three times.

[Volgin (V. I.).] **Волгин (В. И.). List of Granary Mites of the Smolensk Region.** [*In Russian.*]—*Plant Prot.* no. 17 pp. 119–121. Leningrad, 1938.

The examination in July–November 1935 of 147 samples of various stored products, seeds and débris from granaries obtained from different districts in the Province of Smolensk revealed the presence of 18 species of mites, a list of which is given showing their local distribution and prevalence and the products they attacked. They included *Glycyphagus cadaverum*, Schr., which had not previously been recorded from the Russian Union [*cf. R.A.E.*, A **26** 95], but was found in samples of seeds of flax from three districts and of seeds of a fodder grass from one district and was apparently fairly common.

[Sorokin (S.).] **Сорокин (С.). A new Predator of Barn Mites. (Preliminary Communication.)** [*In Russian.*]—*Plant Prot.* no. 17 p. 122. Leningrad, 1938.

In the course of laboratory observations in which the predacious mite, *Cheyletus eruditus*, Schr., was confined in small cells of paraffin wax together with flour mites [*Tyroglyphus farinae*, DeG.], it was noticed

that the latter were being preyed upon by very small reddish Cecidomyiid larvae, which easily penetrated the walls of the cells. Eventually, adult Cecidomyiids appeared in the cells, and a considerable number of them and their larvae were also found in other containers in which flour mites were being reared. They have been identified by H. F. Barnes as an undescribed species of *Trisopsis*, a genus that has not previously been recorded from the Russian Union.

[Kostandyan (L. V.).] **Костандян (Л. В.). On the Biology of *Phytoecia rufimana* Schrank.** [*In Russian.*]—*Plant Prot.* no. 17 pp. 122–124. Leningrad, 1938.

The Lamiid, *Phytoecia coerulea*, Scop. (*rufimana*, Schr.), which has not before been recorded as a pest, attacked cabbage, and to a slight extent radishes, grown for seed in a district in Azerbaijan in 1935. The adults, which were first observed on 10th April, gnawed out long furrows on thin parts of the shoots and stems of the plants. Oviposition started in the second half of April. The eggs were laid singly in the stems or shoots, up to 13 eggs occurring on a plant. In the laboratory, oviposition lasted till 20th May and the eggs hatched in 5 days. Examination of a number of infested cabbage plants showed that 42·4–50 per cent. of the eggs and 20–57·2 per cent. of the larvae had died. It appeared that, irrespective of the number of eggs laid on a plant, only one larva survived, and there was usually only one tunnel in each infested plant. The larva bores within the stem or shoot and gradually makes its way to the underground part of the plant, where it pupates in a chamber after blocking its tunnel with frass. The first pupae were observed on 21st August in nature and rather later in the laboratory. The pupal stage lasted about two weeks, but the young beetles remained in their pupal chambers to hibernate. The control measures suggested are spraying with stomach insecticides in April, when oviposition begins, and the destruction of all remains of cabbage plants after harvest.

[Vinokurov (G. M.).] **Винокуров (Г. М.). On the Lowering of the Norms of Poison Baits for the Control of Grasshoppers.** [*In Russian.*]—*Plant Prot.* no. 17 pp. 124–127. Leningrad, 1938. (With a Summary in English.)

In the summer of 1936, experiments against grasshoppers were made in the Omsk district to ascertain the possibility of reducing the amount of poisoned bait applied per unit of area. The baits were prepared by mixing 3 lb. sodium arsenite paste containing 52 per cent. As_2O_3 with 80 lb. dry horse-dung and 6 gals. water, and were scattered over experimental plots at rates equivalent to 14·4 and 7·2 lb. dry carrier per acre.

The Acridid population consisted mainly of *Aeropus sibiricus*, L., *Stauroderus scalaris*, F. W., *Chorthippus albomarginatus*, DeG., *Dociostaurus crucigerus brevicollis*, Ev., and *Podisma pedestris*, L., and its density was estimated by counting the numbers caught by the sweeping net, or by means of a special frame [*R.A.E.*, A **27** 153]. It was found that at population densities of 12–29 Acridids per sq. yard, the mortality was about 80 per cent. with either rate of application, and it is recommended to adopt the lower rate for general practice.

[Vel'tishchev (P. A.).] **Вельтищев (П. А.). On the Ecology of the solitary Phase of the Moroccan Locust under the Conditions of Highland Karabakh, Trans-Caucasus.** [*In Russian.*]—*Plant Prot.* no. 17 pp. 127–131, 5 refs. Leningrad, 1938.

To determine the natural habitat of the solitary phase of *Dociostaurus maroccanus*, Thnb. [*cf. R.A.E.*, A **22** 242 ; **24** 759], investigations were carried out in 1935 and 1936 in the Karabakh Highlands. Both hoppers and adults were found on stony slopes of the Muravdagh range, at altitudes of 2,300–3,300 ft. In the foothills covered by semi-desert steppe, they were confined to small hillocks of gravelly-clay soil. Here the vegetation consisted mainly of ephemerals such as *Alyssum* and *Bromus* spp., and xerophytes such as *Thymus* sp., *Astragalus aureus* and *Centaurea* spp., and both it and the Acridid biocoenosis were characteristic of the stony slopes lying at higher altitudes. It is concluded that the natural habitat of this species is not in the steppe belt but in the mountains of medium height in the Mediterranean zone as defined in Uvarov's monograph [*cf.* **17** 2].

[Sidel'nik (I.).] **Сидельник (И.). Poisoned Baits in the Control of Tenebrionids.** [*In Russian.*]—*Plant Prot.* no. 17 pp. 131–132. Leningrad, 1938.

In 1935, adults of the Tenebrionid, *Opatrum sabulosum*, L., caused local injury in the Ukraine to sprouting plants of *Perilla* [*cf. R.A.E.*, A **25** 136], sunflowers and late-sown sugar-beet. In field experiments on control, baits of 40 lb. bran or horse-dung, 3 gals. water and 1 lb. Paris green or 3 lb. sodium fluoride were broadcast at the rate of 18 lb. bran or 36 lb. horse-dung per acre. In laboratory tests, Paris green was a more effective poison in the baits than sodium fluoride. Examination of samples of soil from infested fields of *Perilla* three days after the application of the bran baits (the weather having been warm and sunny) showed that 82·3 per cent. of the beetles were killed by baits containing Paris green and 54·9 per cent. by those containing sodium fluoride. Baits of horse-dung and Paris green, which were used in a field of sprouting sugar-beet, gave 66·6 per cent. mortality in three days. The baits would be most effective if applied before the plants began to sprout.

[Parfent'ev (V. Ya.).] **Парфентьев (В. Я.). *Rhyncolus culinaris* Germ. in the Volga Region.** [*In Russian.*]—*Plant Prot.* no. 17 pp. 132–134. Leningrad, 1938.

Investigations carried out in May–September 1936 in a number of towns and villages on the Volga in the Provinces of Saratov and Stalingrad and the Republic of the Volga Germans showed that the timber of about 60 per cent. of all the buildings was damaged by *Rhyncolus culinaris*, Germ. This weevil became established in villages and towns on both banks of the Volga during the civil war, when wood from ruined houses was transported in barges to different places along the river and stored for fuel. Moreover, it is still to be found in wood carried by spring floods, which is also collected for fuel. In buildings, it chiefly infests wood that is periodically made very damp ; infestation is heaviest in the protruding ends of beams on walls particularly exposed to rain. As many as 30 adults could sometimes be found in 16 sq. ins. of infested wood. As infestation is confined

to the sapwood, the degree to which the timber is destroyed depends partly on its thickness. Sections of beams may be reduced to a spongy mass, and the injury is sometimes intensified as a result of simultaneous infestation by *Anobium punctatum*, DeG. (*striatum*, Ol.) or *Trypopitys* (*Priobium*) *carpini*, Hbst. Fresh sound wood is readily attacked if there is a focus of infestation nearby. The adults were present throughout the period of investigations, from May till the end of September, and hibernated. Larvae of different instars occurred in August, and mature larvae were found in May and June, which indicates that they hibernate as well.

[Lukash (I. I.).] **Лукаш (И. И.). The Effectivity of Sodium Fluosilicate and the Rôle of broadcasted Bait in the Control of the Hemp Flea.** [*In Russian.*]—*Plant Prot.* no. 17 pp. 140–143. Leningrad, 1938.

Successful results in the control of the hemp flea-beetle [*Psylliodes attenuata*, Koch] were obtained in a district in northern Ukraine in May 1936 by sowing trap-strips of hemp round the fields to be used for this crop and dusting them with sodium fluosilicate at the rate of 18 lb. per acre. The percentage of beetles killed varied from 64 to 100 in different strips. The value of dusting with sodium fluosilicate against *P. attenuata* was demonstrated in experiments carried out in fields of hemp in various parts of the Russian Union, its numbers being reduced by 75–95 per cent. Hemp should be sown in trap-strips early enough to sprout some three weeks before it is sown in the fields. The best results from dusting with sodium fluosilicate in the fields were obtained by applying 13½ lb. per acre, but a larger quantity should be used on the trap-strips.

[Kuz'min (M.).] **Кузьмин (М.). The Sainfoin Weevil** (*Tanymecus palliatus* **Fahr.).** [*In Ukrainian.*]—*Rozpodd. Sivozm. Biol. Borot'ba Shkodn. sil'skogosp. Roslin* no. 1 pp. 49–55. Kiev, 1936. (Abstr. in Russian in *Plant Prot.* no. 17 pp. 145–146. Leningrad, 1938.)

Observations extended over 6 years on the bionomics of *Tanymecus palliatus*, F., in the forest-steppe zone of the Ukraine showed that it is most abundant in fields of clover, vetch or oats mixed with vetch, and much less numerous in fields of beet or oats alone. The larvae fed chiefly on roots of leguminous plants, but also attacked those of beet and such weeds as *Atriplex*, *Convolvulus*, thistles, *Polygonum* and *Agropyrum*. The presence of weeds in fields of wheat or oats, or in fallow land, invariably increased the infestation. The larvae were able to resist starvation for a comparatively long time, those in the third and fourth instars surviving for an average of 18 days. In the spring, the adults usually emerged from the soil during the last three weeks of May, but in very favourable years they first appeared in the last ten days of April. The overwintered larvae of the second year pupated in June and July [*cf. R.A.E.*, A **26** 237] and became adults in July–August. Thus, only adults and larvae of the first year are present in the soil in the autumn. In October, 61–80 per cent. of the larvae occurred at a depth of 12–18 ins. A mortality of 43–74 per cent. of the weevils was obtained with baits consisting of leaves of weeds wetted with a 2 per cent. solution of sodium fluoride ; baits wetted with

5 per cent. Paris green or barium chloride were less effective. The best results were obtained when the baits were broadcast in the field before the crops sprouted.

Ullyett (G. C.). **Ants and Beneficial Insects.**—*Fmg in S. Afr.* 1938 repr. no. 18, 1 p., 1 ref. Pretoria, 1938.

The author gives a popular account of the ways in which ants impede the biological control of insect pests in South Africa. The group of greatest importance comprises those that foster Aphids and Coccids. The example is given of the citrus mealybug [*Pseudococcus citri*, Risso], reduction of which by native parasites and predators and by the introduced Coccinellid, *Cryptolaemus montrouzieri*, Muls., is considerably hindered by ants. Control of the latter by baits [*R.A.E.*, A **25** 753], or by banding the trunks of the trees and cutting off the branches that touch the ground leads to improved control of the mealybug [*cf.* **21** 277; **23** 142]. Scavenging ants often remove paralysed insects that have been parasitised. In this way, the increase of *Microbracon brevicornis*, Wesm., which parasitises larvae of the maize-ear worm [*Heliothis armigera*, Hb.], is considerably reduced by ants.

Schaefer (C. A.). **Physiological Conditions which produce Wing Development in the Pea Aphid.**—*J. agric. Res.* **57** no. 11 pp. 825–841, 2 figs., 35 refs. Washington, D.C., 1938.

In view of the various conclusions that have been reached as to the factors causing the production of wings in Aphids [*cf. R.A.E.*, A **9** 532; **15** 533; **16** 372; **25** 517, 642], investigations were carried out in Wisconsin during 1935–36 on the influence exerted by the balance of water within the body of *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.) on wing development in that species. Experiments in which Aphid populations were kept on pea seedlings of varying size showed that the number of alate individuals produced varied directly with the size of the population and inversely with the ability of the plant to support populations and its size. Aphids on plants 2–3 ins. high produced a large percentage of alate offspring, but this was not maintained when they were transferred to similar uninfested plants; Aphids on larger plants increased their percentage of alate offspring when transferred. When apterous adults were starved for short periods or placed on wilted or semi-wilted plants, they produced a high proportion of alate progeny, but Aphids similarly treated in the fourth instar did not. The results are given of chemical analyses of alate and apterous Aphids in various stages from lucerne and peas, showing their contents in moisture, fat, protein, ether extract and sugar. The numbers of drops of honeydew excreted in 24 hours by adults from crowded and uncrowded populations on succulent plants averaged 7·9 and 9·9, respectively, and their diameters in microns were 400–650 and 600–800. Starved Aphids produced no honeydew, indicating a relation between the volume of honeydew excreted and the intake of plant sap. Further experiments showed that rapid loss of moisture by evaporation takes place in starved Aphids, with an accompanying increase in protein and ether-extract content. Decreased excretion of honeydew, causing concentration of body substances, is accompanied by the production of alate forms, and is itself induced by crowding

and starvation. These results are discussed. Lack of moisture or heavy early infestations will probably be followed by the appearance of large numbers of winged migrants, which cause an early initial infestation of field peas. In one field during the spring of 1936, when the rainfall was limited, 90 per cent. of the first generation were winged migrants.

Berry (P. A.). **Laboratory Studies on** *Tetrastichus xanthomelaenae* **Rond. and** *Tetrastichus* **sp., two Hymenopterous Egg Parasites of the Elm Leaf Beetle.**—*J. agric. Res.* **57** no. 11 pp. 859–863, 1 fig., 5 refs. Washington, D.C., 1938.

Descriptions are given of the eggs and first-instar larvae of *Tetrastichus xanthomelaenae*, Rond., and an unidentified species of the same genus that was bred in small numbers from parasitised eggs of *Galerucella luteola*, Müll. (*xanthomelaena*, Schr.) imported from France and Austria into the United States in 1932 during attempts to establish *T. xanthomelaenae* for the control of this Galerucid on elm. Characters are given distinguishing the adults of the two Eulophids, but their pupae and late-instar larvae cannot as yet be distinguished. The development of the two species is similar, the period from oviposition to adult emergence averaging 16·9 days in *T. xanthomelaenae* and 17·5 in the other species. Experiments showed that eggs of the Galerucid that had been exposed to both parasites contained eggs and larvae of both, but that only one adult emerged. It was also found that there was no difference in the prospects of survival of the larvae of one or other of the parasites if both had oviposited at the same time, but if either species oviposited a day or more before the other the prospect of survival of its larvae was much greater.

Large numbers of adults of *T. xanthomelaenae* were liberated in the United States in 1932–35, but although it was found to have reproduced in the field in Massachusetts and New Jersey in the year of liberation, none of over 1,100 egg-masses of *G. luteola* collected in 1933 and 1934 from the sites of liberations in the previous years was parasitised.

Muesebeck (C. F. W.). **The Genus** *Dendrosoter* **Wesmael in the United States (Hymenoptera : Braconidae).**—*Proc. ent. Soc. Wash.* **40** no. 9 pp. 281–287, 1 fig., 1 ref. Washington, D.C., 1938.

The only Nearctic species of *Dendrosoter* hitherto described is *D. scolytivorus*, Vier. & Rohw., which is known only from two males obtained in South Dakota. This paper includes descriptions of the genus *Dendrosoter* and of both sexes of *D. scolytivorus*, the female attributed to this species having been obtained on pine in Grand Canyon (National Park), and of three new species from various parts of the United States. A key to the four species is given. The new species comprise : *D. sulcatus* reared from *Ips* spp. and *Dendroctonus frontalis*, Zimm. ; *D. scaber* from a bark-beetle in *Pseudotsuga taxifolia*, and *Pityophthorus* sp. in *Pinus monophylla* ; and *D. integer* from Scolytids in *Libocedrus decurrens*, *Phloeosinus cristatus*, Lec., in Monterey cypress [*Cupressus macrocarpa*] and *Scolytus praeceps*, Lec., in *Abies concolor*.

Chamberlin (J. C.) & Gray (K. W.). **Suggestions for the Control of the Pea Weevil in Oregon with especial Reference to Peas grown for Processing.**—*Sta. Circ.* [*Ore. agric. Exp. Sta.*] no. 126, 23 pp., 16 figs., 1 ref. Corvallis, Ore., 1938.

A brief account is given of the bionomics of *Bruchus pisorum*, L., on peas in Oregon [*cf. R.A.E.*, A **26** 653]. Satisfactory control is afforded by a dust containing 0·75 per cent. rotenone in talc, at the rate of 20–25 lb. per acre. The use of modified dusting machines with nozzles protected from the wind by canvas hoods, the height of which can be adjusted and which can be folded or telescoped when moving from field to field, is desirable in order that applications may be made at the most favourable time independently of weather conditions, and various types of such machines are described and illustrated. Many of the pea plants are bent by the apparatus, but quickly recover. Adults emerging from hibernation first infest the edges of fields; in fields of 10 acres or more it is necessary only to dust a strip 150–250 ft. wide round the edges, and round buildings, patches of scrub or woodland, or other suitable hibernation quarters occurring in the field. Adjacent blocks of varieties with different flowering dates, and isolated patches that flower before the main crop, should be treated as separate units. The emergence of Bruchids from hibernation depends on weather conditions, most appearing at temperatures of 75–80°F., and very few at 65–70°F. A first application of the dust should be made within a few days of flowering and before the pods are set to kill the adults during the pre-oviposition period; it should be followed by a second if necessary within 7–10 days, or within 4–5 days if further adults coming out of hibernation move to the developing peas. A third application may be required if migration continues, unless the crop is within 7–10 days of harvest. In the north-western part of the state in 1937, two applications were necessary on peas flowering in May and early June, but one was sufficient on those flowering in mid-June and July; none was required for very late varieties, as the Bruchids had previously migrated to the earlier varieties and had been destroyed. The use of border trap crops is not practicable in the small fields of western Oregon or Washington.

Garden plots infested by the Bruchid constitute an important source of infestation. Small plantings may be dusted by means of hand dusters as soon as flowering begins and before the pods are set, and thereafter at intervals of 5–8 days until the peak of production is reached.

Hopkins (A. D.). **Bioclimatics. A Science of Life and Climate Relations.**—*Misc. Publ. U.S. Dep. Agric.* no. 280, iv+188 pp., 55 figs. (1 fldg.). Washington, D.C., 1938.

This work is divided into three parts, in the first of which the laws and principles underlying bioclimatics, or the science of relations between climatic, seasonal, biological and distributional phenomena, are set out [*cf. R.A.E.*, A **8** 87, 278]. It has been evolved from the conception of a normal rate of difference in periodical events with latitudes and altitudes, and is largely based on the principle that biological phenomena are controlled by average temperatures. The astronomic law, which determines the broad climatic zonation on the earth, requires the equality of bioclimatic phenomena along equal parallels of latitude, but the astronomic influences are greatly modified

by terrestrial ones, in particular by land and sea distribution. The interaction of these influences creates the local " causation complex," producing considerable deviations of actual climatic and biological phenomena from the requirements of the astronomic law. Instead of parallels of latitude, a system of coordinates is proposed, consisting of isophanes or lines trending from south-east to north-west at the rate of 1° of latitude for 5° of longitude, numbered according to the parallel of latitude crossed by them at longitude 100°W. and longitude 100°E. of Greenwich, and of pheno-meridians, drawn at right angles to the isophanes and numbered according to the meridians of longitude crossed by them at latitude 49°N. According to the bioclimatic law, all bioclimatic phenomena are assumed to be constant across continents at equal altitudes along equal isophanes. The constant values for the isophanes are obtained from observations and records at definite bases. From such records, systems and tables of standard unit constant rates of variation in time and temperature with distance have been evolved, in which 1° of latitude, 5° of longitude and 400 ft. of altitude are taken to be equivalent to a difference of 4 days in time units and 1°F. in thermal units. Such bioclimatic constants are coordinates of the corresponding isophanes, into which they are convertible. As the same unit rates are utilised in computing the constants for different localities, the constants from one base are easily converted into those of another, thus making possible direct comparison of bioclimatic phenomena in different parts of the world. The purpose of bioclimatic constants is to provide reliable bases for measuring the variations from them, for the actual conditions in any locality, measured in terms of temperature, time and distance, always vary from the corresponding constants ; the degree of such variation or the " variation index " indicates the modifying influences and measures their intensity. The procedures in applying these methods are explained and illustrated by numerous examples. The results indicate that preliminary conclusions about an unsurveyed region, made on the basis of records from some representative position within it, are sufficient to determine the bioclimatic features of that region and indicate its economic possibilities up to a point at which local studies can complete the analysis. The results of applying bioclimatics to the study of phenological, entomological and agricultural problems are briefly summarised.

The second part deals with the elements of time and seasons in bioclimatics and with bioclimatic zones [**9** 506 ; **10** 24]. The relations between astronomic seasons, the astroterrestrial seasons, the durations of which are determined by latitude, and the terrestrial seasons, or the foregoing modified by such influences and land and sea distribution and altitudes above sea-level, are discussed. The bioclimatic zonation is based on the principles of time constants in various phenological events and of distance, the elements of which are represented by latitudes, longitudes, isophanes and altitudes, as well as on climatic elements. The values of the respective elements, whenever they can be expressed numerically, are the constants for the corresponding isophanes, so that the zones are an extension of the bioclimatic coordinate system. The major zones are the frigid, temperate and tropical, delimited by the annual temperatures of −6·25, 33·75, 69·85 and 89°F. The divisions within the zones, or " types," are grouped according to whether they are " causation types," *i.e.*, geographic and physiographic, or " response types," *i.e.*, climatic,

seasonal, time, weather, biological or economic. The characteristics of the types are arranged in tables and schedules. In the bioclimatic analysis of a given locality, the causation and response types involved are determined by comparing the records for that locality with the tables and schedules. Preliminary allocation to major and minor zones can be made by means of average temperatures for the year and for the coldest and warmest months. Ecological types cannot be interpreted by bioclimatic methods, but they are closely linked to climatic, weather, seasonal and time types, which can be thus dealt with. The various methods of analysing the different kinds of records for given localities and of allocating the latter to zones and zonal types are explained and illustrated, as well as methods of delimiting zones by various bioclimatic elements. The relations of bioclimatic zones and of precipitation and vegetation types to the physiographic types of the United States are discussed.

The third part contains tables and schedules of time, thermal and distance constants and zonal indices, employed in bioclimatics, explanations of their application, and a glossary.

It is claimed that by applying the bioclimatic laws to entomology, information is rapidly and economically obtained on habitats and on the natural and artificial geographic distribution of native and introduced species of insects, on the climatic and seasonal conditions to which they are best adapted (as shown by zonal and zonal type centres of abundance), on the number of generations and on critical periods at specific localities, and on localities where natural enemies are most likely to occur, as well as on the best way of planning quarantine measures.

Short preliminary notes are given on the results of the application of bioclimatics to the study of *Epilachna varivestis*, Muls., *Cydia pomonella*, L. [*cf.* **21** 651] and *Pyrausta nubilalis*, Hb., with particulars on numbers of generations in different zones and zonal types. The areas where parasites of *Lymantria dispar*, L., are most likely to occur in Japan can be most easily found by bioclimatic methods. The zonal type conditions as represented by the summer temperature and rainfall of Florida indicate that this area is unfavourable to *Ceratitis capitata*, Wied. Investigations on the broods of *Magicicada septendecim*, L., indicate that the bionomics of soil-inhabiting insects tend to vary with variations in latitude and altitude in the same way as those of the air-inhabiting species, but at a slower rate. The determination of average "fly-free dates" and of the best dates for sowing winter wheat in the United States, to escape damage from *Mayetiola destructor*, Say, was successfully accomplished by bioclimatic methods [**8** 89].

ISELY (D.). **Distribution of the Vegetable Weevil in Arkansas.**—*J. Kans. ent. Soc.* **12** no. 1 p. 30. McPherson, Kans., 1939.

Listroderes obliquus, Klug [*cf. R.A.E.*, A **25** 291], a pest of various vegetable crops, was first noted in Arkansas in May 1936 in the south-east. In 1937, it spread to the centre and towards the north-east of the state and was abundant enough to cause damage. A single individual was collected in the north-west in the same year and four additional ones at the same place between 25th March and 31st May 1938, but no injury has been observed in the north-west.

App (B. A.). *Euxesta stigmatias* **Loew, an Otitid Fly infesting Ear Corn in Puerto Rico.**—*J. Agric. Univ. P. Rico* **22** no. 2 pp. 181–188, 1 pl. Rio Piedras, P.R., 1938.

Observations were made during 1935 and 1936 on the bionomics of the Ortalid, *Euxesta stigmatias*, Lw., which causes serious damage to the ears of maize in Porto Rico. Records are given of its distribution, which appears to be general throughout tropical America, and all stages are briefly described. Its food-plants include sugar-cane, guava, and maize; in Porto Rico it was found in all fields of maize in the ear stage surveyed and was present at all seasons. The percentage of ears infested in different fields varied considerably, the lowest observed being 28 in 1935 [*R.A.E.*, A **25** 411] and the highest 97 in 1936.

The adults are abundant in maize fields and congregate about the moist parts of the plant, such as the tassel and the silks. Five females have been observed simultaneously ovipositing on one ear. The eggs are laid below the tips of the husk, generally in rows, after the silks have grown out. A few may be laid before the silks appear; these are pushed out of the husk with them and some may be lost. The larvae feed at first on the young silks, moving downwards till they reach the developing grains, on the contents of which they feed, leaving empty shells; generally, only a few grains at the tip are destroyed, but sometimes an ear is attacked along its whole length. The silks appear to dry normally, but within the husk they rot. The pith of the ear was often attacked and stunted, causing it to produce poor grains or none at all. The appearance of a mould following larval feeding necessitates harvesting seed ears before they are fully mature. Before pupation, the larvae migrate to drier situations. In the laboratory, they pupated in moist sand at a depth of $\frac{1}{4}$ in.; under field conditions, most of them probably pupate in the soil, though a few pupae were found on the tips of the ears among the dry silks. The egg stage lasted 2–4 days, and the larval and pupal stages about a week each; in the field, most of the larvae had pupated by harvest time.

No special experiments on the control of the larvae were carried out, but infestation by them was somewhat reduced (though never by as much as 50 per cent.) by certain treatments tested against *Heliothis armigera*, Hb. (*obsoleta*, F.). These included the application of various dust insecticides and the protection of the tips of the ears by means of paper caps or by constricting them with wire or metal rings.

Cleare (L. D.). **Damage Caused to Rum Puncheons by Boring Beetles.**—*Agric. J. Brit. Guiana* **9** no. 4 pp. 237–245. Georgetown, 1938.

Of 141 puncheons made at Georgetown, British Guiana, of staves imported from the United States, and used to ship a consignment of rum to England in August 1937, 76 were found on arrival to be damaged by boring beetles. Investigations at Georgetown showed that damage by beetles might occur either in the new staves or in the puncheons. In the former case, the staves become infested before reaching the colony and only a small percentage is affected. The damage originally noticed had apparently occurred while the puncheons were in transit to England and was found to have been caused by *Xyleborus badius*, Eichh. Local wood used as dunnage for storing

puncheons on board ship was found to be heavily infested with Scolytids of the same genus, and it is probable that *X. badius* had spread to the puncheons from dunnage. These beetles do not attack dry wood, but might bore into puncheons that had been wet or in contact with some wet substance for a considerable time. A change in the material used for dunnage is recommended.

CLARK (A. F.). **The Occurrence of the Golden Buprestid (*Buprestis aurulenta* L.) in New Zealand.**—*N. Z. J. Sci. Tech.* (B) **20** no. 2 pp. 119B–120B, 2 figs., 4 refs. Wellington, N.Z., 1938.

An adult of the American Buprestid, *Buprestis aurulenta*, L., was caught near Auckland in 1937. The larvae have been recorded as boring in old wood of many species of pines in California and as being particularly attracted to fire scars or exposed pitchy wood. If this species has become established in New Zealand, its partiality for exposed pitchy surfaces may become of significance in connection with the green pruning of conifers, which is now undertaken in some exotic forests.

Insect Pests and their Control.—*Agric. Gaz. N.S.W.* **49** pt. 12 pp. 674–677, 8 figs. Sydney, 1938.

This part of a series on insect pests in New South Wales [*cf. R.A.E.*, A **27** 279] includes brief descriptions of the larva, pupa and adult of the Arctiid, *Eutane terminalis*, Wlk. It has attracted attention because the larvae, which feed on grasses and low herbage, occasionally enter houses in numbers, apparently in search of places in which to pupate.

CALDWELL (N. E. H.). **The Control of Banana Rust Thrips.**—*Qd agric. J.* **50** pts. 2–5 pp. 144–163, 295 316, 422–449, 576–584, 10 figs., 3 maps, 12 refs. Brisbane, 1938.

A detailed account is given of the bionomics of the banana rust thrips, *Scirtothrips signipennis*, Bagn., in Queensland, containing a summary of previous information, and of the nature and distribution of the injury it causes to bananas [*cf. R.A.E.*, A **13** 452; **22** 264; **26** 211]. The history of this thrips in Queensland is reviewed, and its occurrence there and in other parts of the world and the extent to which outbreaks are influenced by physical and climatic factors are discussed. Its economic importance is considered under the headings of actual monetary loss, the extent to which it is responsible for the decline of banana cultivation in certain districts, and its effect on the future progress of the industry.

In recent laboratory studies, the adults survived for up to 50–55 days, the females living considerably longer than the males, and the development period lasted 29–38 days. Mating may take place within a few days of emergence, but may bear little relation to oviposition, as parthenogenetic reproduction has been observed three days after emergence. The sex of offspring produced parthenogenetically has not been determined. The percentage of males in field collections is generally about 30. The average duration of the oviposition period in 7 individuals was 37 days, and the maximum 64. Dense shade increases the rate of reproduction.

The influence on the thrips population of climate, topography, soil, the age of the plantation and cultural practices is discussed, and the habits of the adults and larvae are described, including their distribution on the food-plant, the age composition of the population, their reactions to light and heat, and the extent to which adult flight occurs. Since the distribution of the thrips on the plant is correlated with weather conditions and variations in population density, bunches are almost free from infestation in southern Queensland from late June to mid-September. The relation of *Scirtothrips* to other insects is also discussed; a few predacious enemies have been recorded, but none is of any importance. In 1935, injury caused by this thrips was observed on *Citrus* fruit associated with bananas [**24** 197], and even after the removal of the latter it persisted and bred prolifically. Four native weeds have also been observed to serve as alternative food-plants when allowed to grow with banana, but their economic importance in Queensland is doubtful. The fact that, as shown by laboratory tests, adults and larvae survive for only 2–36 hours in the absence of food, limits the possibilities of dispersion. Infestation is spread locally by wind, but the most important means is by the movement of infested plant material.

An account is given of a number of experiments on the control of the thrips, chiefly by means of dusting, enclosing the fruit in bags, or a combination of these two methods, and it is concluded that the last method is the most satisfactory [**26** 211].

Marloth (R. H.) & Stofberg (F. J.). **The Effect of Lead Arsenate and Copper Carbonate Sprays on the Quality of Oranges.**—*J. Pomol.* **16** no. 4 pp. 329–345, 1 fig., 15 refs. London, 1939.

Investigations were made in the eastern Transvaal during 1932–36 on the effect of lead arsenate and copper carbonate, applied as spot sprays against *Ceratitis capitata*, Wied., and *C. rosa*, Karsch, and as cover sprays against *Argyroploce leucotreta*, Meyr., and *Heliothis armigera*, Hb., on the quality of orange fruits, expressed as the content of the juice in total soluble solids and in acid. The results are tabulated and previous work is briefly reviewed [*cf. R.A.E.*, A **16** 306; **20** 130; **21** 257].

Analyses of random samples were made in 1932 before any spraying was done, and the percentages of soluble solids and acids in the juice and the ratio of soluble solids to acids obtained. The trees were divided into three blocks, each of which was divided into plots for the different treatments and controls. In 1933, all the blocks were given 11 spot sprays consisting of 2 oz. toxic compound and ½ gal. treacle in 4 gals. water at fortnightly intervals, starting on 2nd February. Analyses of fruit were made after the third, seventh and eleventh sprays, when approximately ¼ oz., ½ oz. and 1 oz., respectively, of poison had been applied to each tree. Only two blocks were sprayed in 1934, the other being left for the observation of first-year residual effects. Four cover sprays containing 1 lb. toxic compound and 1 lb. calcium caseinate in 100 gals. water were applied between 27th February and 23rd May, and the fruit was analysed after the second, third and fourth, when each tree had received approximately 1¼ oz., 2 oz. and 2½ oz. of poison. In 1935, one block was given four cover sprays containing twice as much of the toxic compound as in 1934, and the others were left to show first- and second-year residual effects. The fruit was analysed after

the third and fourth sprays, when $3\frac{1}{4}$ and 5 oz. of poison had been applied to each tree. In 1936, three analyses were made, to find the residual effects one, two and three years after spraying, and, as in 1933 and 1934, the first was made when the fruit was full-sized but green, the second when it had started to colour, and the third when it had been well coloured for some time. A cumulative influence of the sprays cannot be presumed as their removal by various means cannot be estimated.

In the case of lead arsenate, the sprays caused a reduction in the percentage of acid in the juice of the fruit, as compared with the controls, the comparative figures for which are here given in brackets. The effect of the spot spray was noticeable after seven applications, and at the end of the season (28th June) the percentage of acid in the juice was 0·62 (0·73). In 1934, the residual effect of spraying in 1933 was evident two months before the normal crop was ready for harvest, and at the end of the season the percentage of acid was 0·48 (0·83). At the end of the second season after application, in which the rainfall was 30 ins., the percentage of acid was 0·88 (1·1), and in the third year no residual effect was observed. The lead-arsenate cover spray on trees spot-sprayed the previous year showed its effects earlier in the season. The acid percentage was 0·68 (0·97) at mid-season (10th May), 0·53 (0·83) at the end of the season, and 0·53 (1·1) a year later. After two years there was little residual effect. In 1935, fruits from trees that again received cover sprays contained 0·87 (1·41) per cent. acid early in the season, 0·52 (1·1) at the end of it, and 0·34 (0·77) at the end of the next. In every case, the effect of the spray was less on the crop maturing at the time of the spray than on the following one, and was still evident on the third crop. The spray on the leaves affects only the neighbouring fruit, but continues to do so as long as the deposit remains on the leaves.

No evidence was obtained of any effect of lead arsenate on the total soluble solids in the fruit juice, and chemical analysis showed that the quantity of arsenic present in the juice of fruit from trees sprayed for three years with lead arsenate was negligible, being only three times that in unsprayed fruit. The amount of arsenic on the rind is very variable, and as the tolerance is calculated on the whole fruit, washing is necessary.

Copper carbonate showed no influence on either the total soluble solids or the acid content of the juice, but the fruit on large trees receiving 5 oz. was found to colour a little early. No increase in lead or copper content of fruit juice above that normally found resulted from any of the cover sprays.

Shaw (H.) & Steer (W.). **Studies on the Toxicity of certain Nitrophenols, Thiocyanates, Naphthalene Derivatives and Organic Bases to the Eggs of some common Orchard Pests.**—*J. Pomol.* **16** no. 4 pp. 364–388, 30 refs. London, 1939.

The ovicidal properties of 44 organic preparations, most of them chemically individual substances, and including dinitrophenols, thiocyanates, naphthalene derivatives and organic bases, were investigated in the laboratory during 1934–37. All the substances were emulsified in 1 per cent. soap solutions (1 per cent. oleic acid and 0·128 per cent. sodium hydroxide), the liquids or solutions of the solids being mixed with oleic acid and added to the requisite amount of

sodium hydroxide dissolved in distilled water. Benzene proved the most satisfactory solvent for the solids. The nitrophenols were used also in sulphite-lye emulsions of petroleum oils and the chlornaphthalenes in casein-Turkey Red oil or goulac emulsions.

Eggs of *Orgyia antiqua*, L., *Aphis pomi*, DeG., and *Operophtera brumata*, L., were used for most of the tests, which were carried out by methods described in a previous paper [*cf. R.A.E.*, A **26** 297], but some tests were made on eggs of *Paratetranychus pilosus*, C. & F. (*Oligonychus ulmi*, auct.) and *Psylla* (*Psyllia*) *mali*, Schm. The most toxic compounds proved to be n-dodecyl thiocyanate (lauryl rhodanate), β-butoxy-β′-thiocyanodiethyl ether, nicotine, and particularly 3 : 5-dinitro-o-cresol, and these were further tested in field trials in Kent on plum trees infested with eggs of *Anuraphis padi*, L., and *Phorodon humuli*, Schr. In 1937, emulsions of lauryl rhodanate and of mixed secondary alkyl thiocyanates, in petroleum oil, and nicotine in soap solution were used, and in 1938, lauryl rhodanate, β-butoxy-β′-thiocyanodiethyl ether, 3 : 5-dinitro-o-cresol and nicotine in petroleum oil emulsions, and nicotine in soap solution. The results of these tests supported those obtained in the laboratory.

So far as the available data permit, attempts are made to correlate differences in toxicity with modifications of molecular structure. The mechanism of the ovicidal action of nicotine is discussed from the results and from the literature in some detail. It was repeatedly observed that eggs treated with nicotine appeared to develop to maturity, but that the larvae died before or during hatching. Since nicotine was fatal to eggs of *O. antiqua* from which the larvae had not attempted to emerge, and to those of Aphids, it does not seem to act as a stomach poison that kills the insect as it eats its way out. Suffocation of the embryo by a film of nicotine covering the egg is unlikely, but a hardening of the chorion is compatible with observed effects. Since, however, it was found to be more effective in sodium oleate than in oil, and when the interval between application and hatching was shortened, the authors consider that the nicotine penetrates the shells and then kills the embryos with fully formed nerves and tracheae, but merely retards the development of those with less developed nervous systems [*cf.* **20** 433 ; **27** 18].

Jary (S. G.) & Austin (M. D.). **Department of Entomology [Report 1937–38].**—*J. S.-E. agric. Coll.* no. 43 pp. 9–14, 7 refs. Wye, Kent, 1939.

Brief notes are given on the more important insect pests observed in south-eastern England in the year ending September 1938 [*cf. R.A.E.*, A **26** 296]. Injury to cereals was not severe except in the case of some late crops damaged by *Chlorops taeniopus*, Mg. The Capsid, *Calocoris norvegicus*, Gmel., and, in Kent, larvae of *Acherontia atropos*, L., were abundant on potatoes. *Kakothrips pisivorus*, Westw., though less common than of recent years, was often associated with *Contarinia pisi*, Winn., in unusually severe attacks on leguminous crops in both Kent and Sussex. Mangels were heavily infested by *Tetranychus telarius*, L., in Surrey, and *Atomaria linearis*, Steph., caused considerable loss of plants in a field newly ploughed out from a three-year ley. *Brevicoryne brassicae*, L., was abundant on swedes at the end of 1937, but caused little damage in 1938. Locally, seed crops of swede were very severely attacked by *Dasyneura brassicae*,

Winn., and *Meligethes aeneus*, F., and the latter completely destroyed the flowers of kale on two fields, before they could open. The Aphelinid, *Encarsia formosa*, Gah., was used successfully against *Trialeurodes vaporariorum*, Westw., on glasshouse crops. In one locality, greenhouse tomatos were heavily infested by the millepede, *Orthomorpha gracilis*, Koch.

Anuraphis roseus, Baker, *Aphis pomi*, DeG., and *Rhopalosiphum prunifoliae*, Fitch, were common on apple, and *Anuraphis padi*, L. (*helichrysi*, Kalt.) on plum. Although a high degree of control with tar-oil washes was commonly obtained, a number of failures were recorded. It seems possible that a slightly higher concentration of tar oils than usual is necessary in some places. Other Aphids that were abundant included *Amphorophora rubi*, Kalt., on raspberries, *A. lactucae*, L. (*cosmopolitana*, Mason), *Macrosiphum ribicola*, Kalt. (*Myzus lactucae*, Schr.), *Aphis grossulariae*, Kalt., and *Capitophorus ribis*, L., on currant and gooseberry, *Macrosiphum rubiellum*, Theo., on cultivated blackberries, and *Myzus cerasi*, F., on cherry. The weevils, *Anthonomus pomorum*, L., and *Rhynchites aequatus*, L., caused some damage to apple, and *Phyllobius pyri*, L., and *P. oblongus*, L., attacked grafts and young trees.

Widespread injury to hops, resulting in some cases in damage to 15–20 per cent. of the cones, was caused by *Contarinia* (*Diplosis*) *humuli*, Tölg, and local injury by *Euacanthus interruptus*, L., *Phorodon humuli*, Schr., and *Psylliodes attenuata*, Koch.

A Trypetid of the genus *Tephritis*, hitherto unknown in England and apparently indigenous in the Canary Islands, caused terminal galls on the stems of chrysanthemums in Kent in July.

Heinze (K.). **Spritzversuche zur Abtötung viruskranker Pflanzen in Kartoffelhochzuchtbeständen und zur vorzeitigen Krautabtötung.** [Experimental Spraying to kill Virus-infected Potato Plants in Selection Plots and to kill off Potato Plants in entire Fields.]—*Z. PflKrankh.* **49** pt. 3 pp. 129–142, 3 figs., 15 refs. Stuttgart, 1939.

To prevent the spread of potato virus diseases in selection plots, it is customary to dig up and remove infected plants, but this allows Aphid vectors to fly or be shaken from them. Destruction of such plants by a suitable spray kills both the source of infection and the vectors. Descriptions are given of laboratory and field experiments in Germany on sprays toxic to such individual plants. A spray containing 2·5 per cent. tar distillate, 2·5 per cent. cresol and 1 per cent. soft soap killed infected plants in one day, and on 8 plants sprayed in the field, only two living Aphids could be found. Plants sprayed with 5 per cent. sodium chlorate combined with 0·1 per cent. nicotine and a spreader were killed by the following morning, and all Aphids on them were also killed.

In years of great Aphid abundance, the virus can be prevented from reaching the tubers by killing all the plants in a field a short time before the tubers have completely matured. A proprietary weed killer [containing iron nitrate] proved effective for this purpose, as insecticidal action is not necessary. To ascertain the degree of infestation, leaves are picked from the middle and lower parts of the plants 3–4 weeks before the crop is to be lifted; if less than 15

individuals of *Myzus* (*Myzodes*) *persicae*, Sulz. (other Aphids being disregarded) are found on every 100 leaves, there is no need to kill the plants.

HORNBOSTEL (W.). **Kann** *Beauveria densa* (**Link**) **auch die Eier des Maikäfers befallen ?** [Can *B. densa* also attack the Eggs of May Beetles ?]—*Z. PflKrankh.* **49** pt. 3 pp. 142–144, 3 figs. Stuttgart 1939.

Beauveria densa causes a fatal infection, often epidemic in character, in larvae, pupae and adults of *Melolontha* spp. in Germany. The author has infected and killed the eggs in the laboratory by placing spores of the fungus on them.

RADEMACHER (B.). **Ueber die Milderung der Läuseschäden** (*Doralis fabae* **Scop.**) **bei Pferdebohnen durch Frühsaat, Voranzucht und Anbau als Winterfrucht.** [On the Attenuation of Injury by Aphids (*Aphis fabae*) to *Vicia faba* by early Sowing, Forcing and Cultivation as a Winter Crop.]—*Z. PflKrankh.* **49** pt. 3 pp. 144–160, 5 figs., 16 refs. Stuttgart, 1939.

In Germany, *Aphis* (*Doralis*) *fabae*, Scop., is the most important pest of horse beans and broad beans (varieties of *Vicia faba*), and no effective measure for its control is known. Experiments carried out at intervals from 1930 to 1938 confirmed the value of early sowing to give the best crop yields [*R.A.E.*, A **23** 85]. Early sowing does not absolutely ensure that the plants will blossom before the appearance of the Aphids, but this has been achieved in the vegetable-growing districts in the Rhineland by forcing broad beans in greenhouses and planting them out at such a date that the green pods can be marketed for table use from the end of May onwards. Infestation of horse beans can be similarly prevented to a great extent by growing hardy varieties as a winter crop.

BLUNCK (H.). **Viruskrankheiten bei Pflanzen.** [Virus Diseases of Plants.]—*Z. PflKrankh.* **49** pt. 3 pp. 177–222, 8 pp. refs. Stuttgart, 1939.

This is a text of a lecture giving a survey of the main outlines of present-day knowledge of the virus diseases of plants, including the relation of insects to them.

GÄBLER (H.). **Die Bedeutung der Larven von** *Syrphus tricinctus* **Fall. für die Vernichtung von Raupen und Afterraupen.** [The Importance of the Larvae of *S. tricinctus* for the Destruction of Larvae of Lepidoptera and Tenthredinids.]—*Tharandt. forstl. Jb.* **90** pt. 1 pp. 69–74, 2 figs., 11 refs. Berlin, 1939.

Syrphid larvae are generally regarded as predacious on Aphids, but references in the literature show that they occasionally attack larvae of other insects. In July 1938, the author observed larvae of *Syrphus tricinctus*, Fall., the larva, puparium and adult of which are described, preying on those of *Pachynematus scutellatus*, Htg., on spruce in Saxony. In cages, they readily preyed upon larvae of this sawfly and *Pristiphora abietina*, Christ (*Lygaeonematus pini*, Retz.),

and they also attacked second- and third-instar larvae of the nun moth [*Lymantria monacha*, L.], but usually relinquished these after 10–20 minutes.

Nolte (H. W.). **Die Tachinierung der Nonnenraupen in einigen sächsischen Revieren in den Jahren 1937 und 1938.** [The Parasitism of Nun Moth Larvae by Tachinids in some Saxon Forests in 1937 and 1938.]—*Tharandt. forstl. Jb.* **90** pt. 1 pp. 74–78, 3 refs. Berlin, 1939.

Notes are given on the parasitism of the nun moth [*Lymantria monacha*, L.] by Tachinids, principally *Phorocera silvestris*, R.-D. (*Parasetigena segregata*, auct.) in a few forestry divisions in Saxony. In 1937, 38,996 larvae and pupae of the moth were collected during four weeks in June and July, while in 1938, 4,813 were taken in July. In 1937, the percentages parasitised in five divisions were 4·6, 14·3, 23·6, 10·5, and 11·3, respectively. In 1938, they were 22·1 and 22·8 in the last two of these five divisions and 24·2 in a sixth.

Gösswald (K.). **Richtlinien zur beschleunigten Heranzucht von Larven des Hausbocks** *Hylotrupes bajulus* **L.** [Guides for the accelerated Rearing of Larvae of *H. bajulus*.]—*NachrBl. dtsch. PflSchDienst* **19** no. 3 pp. 17–19, 6 refs. Berlin, 1939.

Detailed studies on the biology of *Hylotrupes bajulus*, L., which has become a serious pest of constructional timber in Germany [*R.A.E.*, A **27** 202, etc.], are hampered by the slow rate of development of the larvae. In this paper is described a method of increasing the nutritive value of pine wood by impregnating the blocks under pressure with a 5 per cent. suspension of diastase. This accelerated larval development; in a comparable experiment at room temperature, larvae in treated and untreated wood weighed 114 and 2 mg., respectively, after 6 months. Diastase proved more satisfactory than peptone or other ferments.

Vesey-Fitzgerald (D.). **Entomology.**—*Rep. Dep. Agric. Seychelles 1937* pp. 22–24. Victoria, Seychelles, 1938.

Notes are given on the prevalence, in various types of land in the Seychelles and in the various islands, of the Coccids that attack coconut [*cf. R.A.E.*, A **26** 433]. The introduced Coccinellids, *Chilocorus distigma*, Klug, and *Exochomus ventralis*, Gerst., have been distributed to various districts, and every colony that has been visited has become established. One locality has been nearly cleared of *Ischnaspis longirostris*, Sign., by *C. distigma* in a year. Though an ant (*Technomyrmex*) has interfered with the breeding of *E. ventralis*, the latter is locally abundant on coconuts and has cleared various fruit trees of Lecaniine scales. *C. wahlbergi*, Muls., has not bred freely, and since it is inferior to *C. distigma*, no breeding programme was undertaken, but it is established on one island. *E. flavipes*, Thnb., was found on three islands feeding on Lecaniine scales on wild plants and was introduced in to Mahé, where it has become established.

Minor pests noticed during the year included *Symitha mangifera*, Tams, on mango, *Crocidolomia binotalis*, Zell., on garden vegetables, *Sylepta derogata*, F., on okra [*Hibiscus esculentus*], a Delphacid of the genus *Stenocranus* on coconut, and *Etiella behri*, Zell., which feeds

on the pods of pigeon peas [*Cajanus cajan*], making it impracticable to grow the crop in the Seychelles. A species of *Polistes* is predacious on *C. binotalis*.

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CONTENTS.

CONTENTS—*cont.*

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